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ZOOLOGIE

1995

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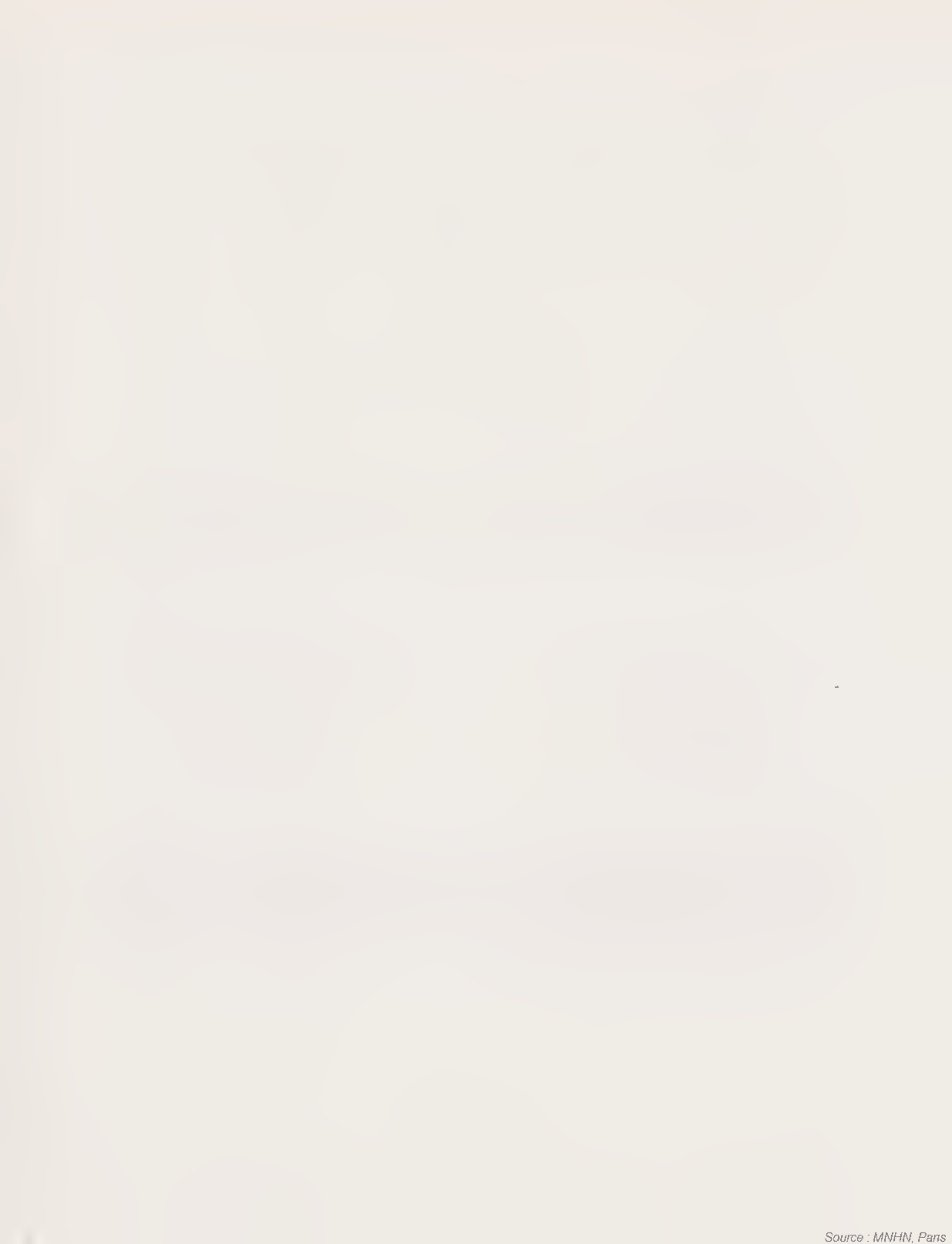

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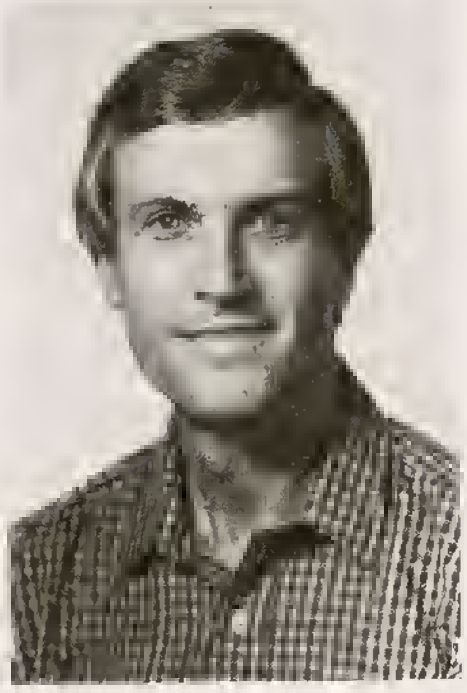

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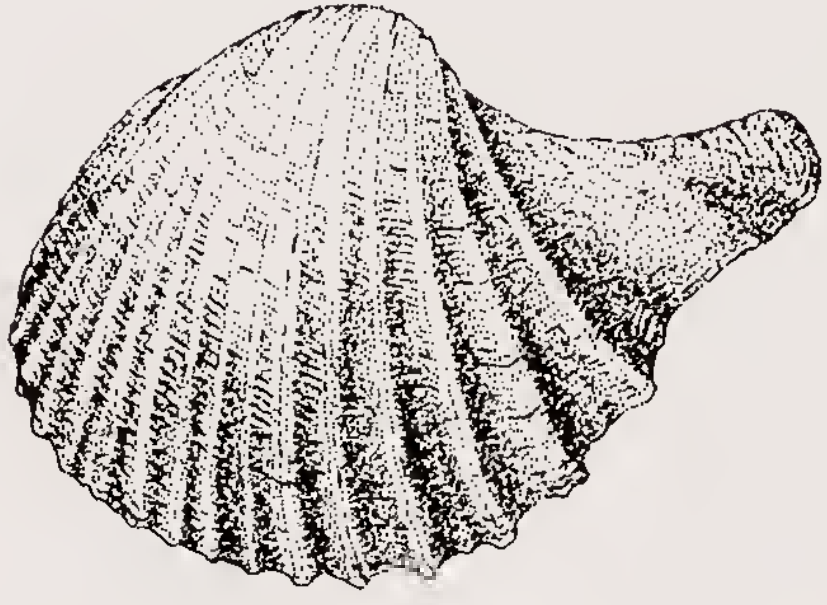
Volume 14



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1

Bathyal Pectinoidea (Bivalvia: Propeamussiidae, Entoliidae, Pectinidae) from New Caledonia and adjacent areas

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ABSTRACT

The biological exploration of deep-sea benthos off New Caledonia during the years 1978-1989 has yielded a rich mollusc fauna, including 30 species of Pectinoidea. The highest diversity, with 14 species, is observed in the 600-800 m depth interval, and only three species have been collected below 1500 m. The fauna belongs to Propeamussiidae (21 species, all taken alive), Entoliidae (1 species, alive), and Pectinidae (8 species, 6 taken alive). Nine species are new to science: *Parvamussium multiliratum*, *P. retiaculum*, *P. retiolum*, *P. squalidulum*, *P. undisonum*, *P. vesiculatum*, *Cyclopecten horridus*, *C. pellucidulus* (Propeamussiidae), and *Hyalopecten mireilleae* (Pectinidae). Most of the other species are new records for the region. Ten lectotypes are designated, one new synonym and one new combination recognized. This pectinoid fauna shows a strong similarity to that of the wider Indo-Pacific, and marginally to that of northern New Zealand and southeastern Australia.

RÉSUMÉ

Les Pectinoidea bathyaux (Bivalvia: Propeamussiidae, Entoliidae et Pectinidae) de Nouvelle-Calédonie et des régions voisines.

Les campagnes océanographiques réalisées de 1979 à 1989 autour de la Nouvelle-Calédonie ont récolté une riche faune de mollusques bathyaux et abyssaux, dont 30 espèces de bivalves Pectinoidea. Le maximum de diversité est observé entre 600 et 800 m de profondeur, avec 14 espèces, alors que trois espèces seulement ont été récoltées à plus de 1500 m. Cette faunule se répartit en Propeamussiidae (21 espèces, toutes récoltées vivantes), Entoliidae (1 espèce, vivante), et Pectinidae (8 espèces, dont 6 récoltées vivantes). Neuf espèces nouvelles sont décrites : *Parvamussium multiliratum*, *P. retiaculum*, *P. retiolum*, *P.*

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squalidulum, P. undisonum, P. vesiculatum, Cyclopecten horridus, C. pellucidulus (Propeamussiidae), et *Hyalopecten mireilleae* (Pectinidae). La plupart des autres espèces sont signalées pour la première fois de ce secteur géographique. Des lectotypes sont désignés pour dix taxons, et une nouvelle synonymie et une nouvelle combinaison sont établies. Cette faune de Pectinoidea fait incontestablement partie de l'Indo-Pacifique avec, marginalement, quelques affinités avec le Nord de la Nouvelle-Zélande et le Sud-Est de l'Australie.

INTRODUCTION

Deep-sea pectinoid bivalves from the tropical South-West Pacific are poorly known, and only a few species were described by previous authors (E.A. SMITH, 1885; HEDLEY, 1902). During the years 1978-1989 several French expeditions have collected rich samples of marine biota from bathyal depths around New Caledonia, including many pectinoidean bivalves. The species treated here are those occurring at depths below 100 m, *i.e.* all the littoral and reef associated species are not considered. With these limitations, the collection comprises 21 species of Propeamussiidae (all taken alive), one species of Entoliidae (alive), and 8 species of Pectinidae (6 taken alive), a total of 30 pectinoids. To make the survey of New Caledonia Propeamussiidae more complete, *Parvamussium pauciliratum*, a shallow-water species, is also treated and illustrated.

The present paper completes the revision of the pectinoids of New Caledonia. In a series of papers, DIJKSTRA (1983 to 1994) and DIJKSTRA *et al.* (1989, 1990) recorded the occurence of 33 species of Pectinidae from the reefs and coral reef lagoons.

As for other papers in this volume, the material studied was collected during the cruises reported on by RICHER DE FORGES (1990, 1993). For descriptions of deep-sea bottom topography and faunal zonation around New Caledonia, I refer to ROUX (1991) and ROUX *et al.* (1991). In species descriptions, morphological terminology follows WALLER (1978, 1984, 1991, 1993) and WALLER & MARINCOVICH (1992).

Comparative material from the Indo-Pacific and type material was studied from various museum collections, viz. AMS, BMNH, KBIN, MNHN, NMNZ, NMP, NMW, RMNH, ZMA, ZMC, ZSI. The present material is stored in MNHN; paratypes have been distributed to other museums, including the reference collection of the author.

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

AIM : Auckland Institute and Museum, Auckland
AMS : Australian Museum, Sydney
BMNH : The Natural History Museum, London
HD : H.H. Dijkstra collection
IOAS : Institute of Oceanology, Academia Sinica, Qingdao
KBIN : Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels
MCZ : Museum of Comparative Zoology, Cambridge (U.S.A.)
MNHN : Muséum national d'Histoire naturelle, Paris
NMNZ : Museum of New Zealand *Te Papa Tongarewa*, Wellington
NMP : Natal Museum, Pietermaritzburg
NMV : National Museum of Victoria, Melbourne
NMW : National Museum of Wales, Cardiff
NSMT : National Science Museum, Tokyo
RMNH : Nationaal Natuurhistorisch Museum, Leiden
USNM : National Museum of Natural History, Washington, DC
ZMA : Zoölogisch Museum, Amsterdam
ZMC : Zoologisk Museum, Copenhagen
ZSI : Zoological Survey of India, New Alipur, Calcutta

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Station data

CC : Chalut à crevettes (Shrimp Trawl)
CP : Chalut à perche (Beam Trawl)
DC : Drague Charcot (Charcot Dredge)
DE : Drague épibenthique (Epibenthic Sledge)
DS : Drague épibenthique Sanders (Sanders epibenthic Sledge)
DW : Drague Warén (Warén Dredge)
KG : Carottier Usnel grande surface (Usnel Box-Corer)

Other abbreviations

db : doublet (paired valves, dead collected)
lv : left valve(s)
rv : right valve(s)
spm(s) : live-taken specimen(s)
v : valve(s)
OD : Original designation
SD : Subsequent designation.

SYSTEMATIC ACCOUNT

Class Bivalvia Linnaeus, 1758

Subclass Pteriomorphia Beurlen, 1944 [emend., Boss 1982]

Superorder Eupteriomorphia Boss, 1982

Order Ostreoida Waller, 1978

Suborder Pectinina Waller, 1978

Superfamily Pectinoidea Wilkes, 1810 [emend., Waller 1978]

Family Propeamussiidae Abbott, 1954

Propeamussiidae Abbott, 1954: 361, 369.

Diagnostic characters. — Free or byssate Pectinoidea with outer foliated calcitic layer on left valve and prismatic calcitic layer on right valve present on the main part of the disc; inner layer crossed-lamellar aragonite beyond pallial line, sometimes nearly to distal margins; byssal notch without ctenolium.

Remarks. — Hertlein (1969: N350) placed *Propeamussium* (with *Parvamussium*), as a subgenus together with *Amusium* Röding, 1798 and *Korobkovia* Glibert & van de Poel, 1965 in the *Amusium*-group, with the note that these genera may have been derived from different groups in Pectinidae. Abbott (1954), however, had introduced a new family Propeamussiidae [emended by Waller (1978: 353)], for *Propeamussium*. Waller (1984) also included several other related genera in Propeamussiidae, viz. *Parvamussium*, *Cyclopecten* Verrill, 1897, *Similipecten* Winckworth, 1932, and *Catillopecten* Iredale, 1939. Hayami (1988a) mentioned also *Polynemamussium* Habe, 1951 as a Recent genus of Propeamussiidae, and treated *Parvamussium* as a synonym of *Propeamussium*. Subsequently, Hayami & Kase (1993: 54) raised *Parvamussium* in rank to genus.

As Hayami (1988b) and Waller (1991, 1993) mentioned, the suprageneric classification of the Pectinoidea is still in disorder and under appraisal.

Source MNHN, Paris

Genus *Propeamussium* de Gregorio, 1884

Propeamussium de Gregorio, 1884: 119. [Proposed as a subgenus of *Pecten*]. Type species (OD): *Pecten (Propeamussium) ceciliae* de Gregorio, 1884; Miocene, Sicily, Italy.

Synonyms:

Paramussium Verrill, 1897: 72. Type species (OD): *Amussium dalli* E.A.Smith, 1885; Recent, off Bermuda, W Atlantic, 796 m.
Occultamussium Korobkov, 1937: 56. [Proposed as a subgenus of *Amussium*]. Type species (OD): *Pecten semiradiatus* Mayer, 1861; Upper Eocene, Austria.
Pseudopalliorum Oyama, 1944: 244. [Proposed as a subgenus of *Propeamussium*]. Type species (OD): *Pecten interradiatus* Gabb, 1869; Eocene, California, USA.
Bathymussium Oyama, 1951: 79. [Proposed as a subgenus of *Ctenamusium*]. Type species (OD): *Amussium jeffreysii* E.A.Smith, 1885; Recent, N Sulu Sea, Philippines, 686 m.
Micramussium Oyama, 1951: 80. [Proposed as a subgenus of *Ctenamusium*]. Type species (OD): *Ctenamusium (Micramussium) siratama* Oyama, 1951; Recent, Japan, 234-291 m.
Flavamussium Oyama, 1951: 81. [Proposed as a subgenus of *Parvamussium*]. Type species (OD): *Amussium caducum* E.A.Smith, 1885; Recent, Philippines, 1280 m.
Luteamussium Oyama, 1951: 82. Type species (OD): *Anussium sibogai* Dautzenberg & Bavay, 1904; Recent, Indonesia, 289 m.

DIAGNOSIS. — *Shell* equivalve, fragile, usually rather small, mostly transparent, laterally compressed, gaping along lateral margins; *left valve* smooth or sculptured with fine radial and/or concentric riblets or striae, *right valve* with concentric lines or lirae; auricles nearly equal to equal; byssal notch moderately slight; no ctenolium; internal riblets extend to submarginal region.

DISTRIBUTION. — Jurassic-Recent. Worldwide; 275-2740 m (WALLER, 1971).

REMARKS. — GRAU (1959) repeated the original diagnosis of *Propeamussium*, and of the type species *P. ceciliae*, with a translation in English. The red colour of the fossil shell described by DE GREGORIO, is probably the colour of iron oxyde, as commented by GALE (*in* GRANT & GALE, 1931: 232). The type specimen has been subsequently figured by DE GREGORIO (1898: pl. 4, figs 10-12). Figures 13 and 14, also referred to by GRAU (1959: 9) do not belong to the type species. HERTLEIN (1969: N350) has reproduced DE GREGORIO's illustration of the right (*sic*) valve of the holotype. NORTH (1951b: 123) mentioned that he could not trace the holotype.

GRAU (1959: 9) placed *Paramussium*, *Pseudopalliorum*, *Flavamussium* and *Luteamussium* in the synonymy of *Propeamussium*, and HERTLEIN (1969: N350) subsequently added also *Occultamussium*, and *Actinopecten* with a question mark. HAYAMI (1988a) enumerated also *Parvamussium*, *Ctenamussium* (*sic*), *Glyptamusium* "Oyama, 1944" (*sic*) [= *Glyptamusium* Iredale, 1939], *Bathyamussium* and *Micramussium* as synonyms of *Propeamussium*. However, the type species of *Ctenamusium* and *Glyptamusium* are morphologically similar to *Parvamussium*, whereas the type species of *Bathymussium* and *Micramussium* are more similar to *Propeamussium*.

Differences in shell characters of *Propeamussium* and *Parvamussium* are summarized in Table 1.

TABLE 1. — Characters of *Propeamussium* and *Parvamussium*.

	Propeamussium	*Parvamussium*
dimension	10 - 85 mm	5 - 20 mm
shape	orbicular to oval	orbicular to oblique
lateral gape	present	absent
byssal notch	absent	well developed
auricles	equal or nearly equal	unequal
internal ribs	starting in early ontogeny and developed to central or sub-marginal area	starting later and developed to marginal area

Source : MNHN, Paris

Propeamussium alcocki (E.A. Smith, 1894)

Figs 1-4, 133-137

Amussium alcocki E.A. Smith, 1894: 172, pl. 5, figs 15-16.

Other references:

Amussium alcocki – Alcock & Anderson, 1897: pl. 2, figs 3-3a. — Alcock, 1902: 282, fig. 79. — E.A. Smith, 1906: 255. — Thiele & Jaeckel, 1931: 8. — Winckworth, 1940: 26.
Propeamussium alcocki – Abbott & Dance, 1982: 303.

Type material. — Lectotype (Figs 133-7, H 40.4, L 39.8, D 7.9 mm) here designated ZSI 6154/9, live taken. Three paralectotypes: BMNH 1894.9.11.1, NMW 1955.158.785, ZMC. The types are somewhat damaged near the margins, and the right valves of three of them (ZSI, BMNH, NMW) are restored.

Type locality. — *"Investigator"*, stn 105, 15°02′ N, 72°34′ E, Laccadive Sea, 1353 m.

Material examined. — The type material.
Chesterfield Islands. CORAIL 2: stn DW 171, 18°24′ S, 155°22′ E, 650 m, 2 lv, 1 rv.
New Caledonia. BIOCAL: stn CP 75, 22°18′ S, 167°23′ E, 825-860 m, 23 spms.
BIOGEOCAL: stn CP 232, 21°33′ S, 166°27′ E, 760-790 m, 3 spms.
Loyalty Islands. MUSORSTOM 6: stn CP 427, 20°23′ S, 166°20′ E, 800 m, 6 spms. — Stn CP 438, 20°23′ S, 166°20′ E, 780 m, 5 spms.

Distribution. — Laccadive Sea and Bay of Bengal (Smith, 1894; Alcock, 1902), Gulf of Aden (Thiele & Jaeckel, 1931) and New Caledonia, Chesterfield Islands and Loyalty Islands. Present material living at 760-860 m.

Description. — *Shell* inequivalve, circular, up to ca. 50 mm high, inequilateral, fragile, creamy, translucent.
Prodissoconch ca. 240 µm in height.
Left valve somewhat more convex than right, with some concentric growth lines, and 1-3 fine radial lirae near posterior margin. Anterior margin more convex than posterior. Auricles equal, smooth, anterior margin somewhat raised. Eight to 10 internal riblets entering from near resilifer to two-thirds length of adult disc, somewhat finer than on right valve; one auricular lira on each side.
Right valve covered with wide-set concentric costae, commencing at ca. 3 mm shell length, with granulate interstitial microsculpture. Auricles with small concentric striations, prominent scales on posterior and anterior dorsal margins. Resilifer triangular. No byssal notch, or ctenolium.

Remarks. — The present material of *Propeamussium alcocki* is similar to the type specimens, although the coloration is somewhat different (creamy instead of transparent white). All of the present specimens lack concentric lamellae near the ventral margin and minute radiations on the central part of the disc of the left valve. Knudsen (1967: 281) considered *P. alcocki* a junior synonym of *P. watsoni*, and interpreted as variation the differences in shape (circular to nearly oval), concentric sculpture of right valve (varies in setting), and radiating sculpture of left valve (varies in development) of his material from the Indian Ocean. I did not observe these variations in the material from around New Caledonia and the two species are well defined conchologically (see descriptions).

P. alcocki has been refered to *Amussium* Hermannsen, 1846 [emendation of *Amusium* Röding, 1798] by a number of authors, but that genus belongs to Pectinidae.

Source : MNHN, Paris

FIGS 1-8. — **1-4**, *Propeamussium alcocki*, BIOCAL: stn CP 75, 46.1 x 39.8 mm (db). — **1**, left valve, exterior. — **2**, left valve, interior. — **3**, right valve, exterior. — **4**, right valve, interior. — **5-8**, *P. andamanicum*, BIOCAL: stn CP 74, 44.9 x 36.8 mm (db). — **5**, left valve, exterior. — **6**, left valve, interior. — **7**, right valve, exterior. — **8**, right valve, interior.

Source MNHN, Paris

Propeamussium andamanicum (E.A. Smith, 1894)

Figs 5-8, 138-142

Amussium andamanicum E.A. Smith, 1894: 172-173, pl. 5, figs 13-14.

Other referenees:

Amussium andamanicum – E.A. Smith, 1895b: 265. — Alcock & Anderson, 1897: pl. 2, figs 1-1a. — E.A. Smith, 1904: 14. — Winckworth, 1940: 26. — Knudsen, 1967: 273, pl. 1, fig. 22, textfig. 15.

Type material. — Lectotype (Figs 138-142, H 30.2, L 22.4, D 6.4 mm) here designated ZSI 7418/9, live taken. The type specimen is somewhat damaged on the posterior margin of the left valve and ventral margin of the right valve. Therefore its current dimensions differ from those in the original description. Smith (1895b, 1904) indicated material from different stations of *"Investigator"*, however he mentioned only one station in the original description. Material from *"Investigator"*, stn 122 and 192 do not belong to the type series.

Type locality. — *"Investigator"*, stn 113, 12°59′ N, 93°23′10″ E, Andaman Sea, 1249 m. Smith (1894) mentioned a depth of 688-922 fathoms [= 1258-1686 m], which should be 683 fathoms [= 1249 m] (stn 113) and 922 fathoms [= 1686 m] (stn 114). On a printed label of the Indian Museum is written in ink station number "113" and a depth of "683" fathoms (see Fig. 138).

Material examined. — The type material.
New Caledonia. BIOCAL: stn CP 74, 22°14′ S, 167°29′ E, 1300-1475 m, 1 spm.
BIOGEOCAL: stn CP 238, 21°27′ S, 166°23′ E, 1260-1300 m, 1 spm.

Distribution. — Andaman Sea, Laccadive Sea and Arabian Sea (Smith, 1895b, 1904), Zanzibar area and the Gulf of Aden (Knudsen, 1967), and now New Caledonia. Present material living at 1260-1475 m.

Description. — *Shell* fragile, hyaline, up to ca. 45 mm high, elongate, umbonal angle ca. 90°, left valve transparent-white, right valve creamy.

Prodissoconch ca. 250 µm in height (Knudsen, 1967).

Left valve somewhat more convex than right, ornamented with widespread concentric lirae that commence near the central part of dise and extend to ventral margin. Auricles equal and rather small, with delicate concentric striations. Anterior and posterior margin of auricles somewhat raised. Small scales on dorsal edge of aurieles. Interior lirae commencing directly below resilifer, 9-11, with one small auricular lira on each side, all gradually enlarging.

Right valve covered with concentric lirae and interstitial granulated microsculpture (prismatic calcite layer). Aurieles with delicate concentric striae. Dorsal margin with prominent scales. No byssal notch, no ctenolium. Resilifer rather triangular elongate.

Remarks. — The present specimens resemble the type material, although the concentric lirae of the left valve are more delicate and start somewhat earlier. The internal riblets are variable in length and number. *P. andamanicum* is closest to *P. alcocki*, and is a typical *Propeamussium*.

Propeamussium caducum (E.A. Smith, 1885)

Figs 9-10, 129-132

Amussium caducum E.A. Smith, 1885: 309, pl. 23, figs 1-1c.

Synonyms:

Amussium weberi Dautzenberg & Bavay, 1912: 32, pl. 28, figs 9-13.
Propeamussium nakazawai Kuroda, 1932: 87, figs 101-102 (*nomen nudum*). Synonymy established by Oyama (1951), and subsequently followed by Habe (1958, 1977) and Knudsen (1967).

Source MNHN, Paris

FIGS 9-14. — **9-10**, *Propeamussium caducum*, *"Vauban"* 1978-79: stn 31, 27.9 x 25.9 mm (db). — **9**, left valve, exterior. — **10**, right valve, exterior. — **11-14**, *P. maorium*, MUSORSTOM 4: stn CP 169, 19.2 x 18.3 mm (db). — **11**, left valve, exterior. — **12**, left valve, interior. — **13**, right valve, exterior. — **14**, right valve, interior.

Source : MNHN, Paris

Other references:

Amussium caducum – E.A. Smith, 1894: 173; 1895a: 18; 1904: 13; 1906: 255. — Melvill & Standen, 1907: 807. — Thiele & Jaeckel, 1931: 7. — Winckworth, 1940: 26.
Parvamussium (Flavamussium) caducum – Oyama, 1951: 81, pl. 13, figs 11-12. — Kira, 1967: 138, pl. 49, fig. 15.
Flavamussium caducum – Habe, 1958: 267, pl. 11, fig. 26.
Propeamussium caducum – Hayami, 1988a: 476. — Okutani, Tagawa & Horikawa, 1989: 58, figs. — Dijkstra, 1991: 6, figs 1-2.
Propeamussium (Propeamussium) caducum – Wang, 1984: 599, pl. 1, figs 3-4, textfig. 2. — Dijkstra, 1990: 9-10.

Type material. — *A. caducum*: lectotype (Figs 129-132, H 20.9, L 18.8, D 4.5 mm), here designated BMNH 1887.2.9.3310, 4 paralectotypes BMNH 1887.2.9.3311/1-4. The anterior and posterior margins of the left valve and the marginal apron of the right valve of the holotype are broken off; in consequence the measurements differ slightly from the original ones. — *A. weberi*: lectotype, here designated ZMA 3.12.013, paralectotypes ZMA, RMNH, KBIN, MCZ. — *P. nakazawai*: holotype not seen.

Type locality. — *A. caducum*: "*Challenger*", stn 207, 12°21′ N, 122°15′ E, W of Luzon, Philippines, alive, 1280 m. — *A. weberi*: "*Siboga*", stn 316, 7°19.4′ S, 116°49.5′ E, Bali Sea, alive, 538 m. — *P. nakazawai*: Suruga Bay, Japan, alive, 549-732 m.

Material examined. — **New Caledonia**. "*Vauban*" 1978-79: stn 31, 22°31′ S, 166° 25′ E, 450-550 m, 2 spms. — Stn 32, 22°32′ S, 166°25′ E, 430-500 m, 2 rv. — Stn 33, 22°33′ S, 166°25′ E, 290-350 m, 1 lv. — Stn 34, 22°32′ S, 166°26′ E, 350-420 m, 2 lv.

Distribution. — Japan (Oyama, 1951; Kira, 1967), Philippines (Smith 1885; Oyama, 1951; Knudsen, 1967), Indonesian Archipelago (Dautzenberg & Bavay, 1912; Thiele & Jaeckel, 1931; Dijkstra, 1991), Arabian Sea and Bay of Bengal (Smith, 1894, 1895a, 1904, 1906), Gulf of Aden and Zanzibar area (Knudsen, 1967). Now also New Caledonia. Present material living at 450-550 m.

Description. – *Shell* slightly inequivalve, fragile, nearly equilateral, up to ca. 25 mm high, somewhat higher than wide, rather opaque, glossy, creamy, umbonal angle about 90°, left valve somewhat more convex than the right.

Prodissoconch ca. 215 µm in height (Knudsen, 1967).

Left valve smooth, ornamented with concentric growth lines, no radial striations. Auricles rather small, without sculpture, somewhat raised near margins.

Right valve sculptured with wide-set concentric lirae, commencing at 3 mm shell height and extending to submarginal area, microscopic radial scratches between them. Auricles with very fine concentric striae, strong scales produced on the marginal areas of hinge. Hinge line straight near umbo, then rising near anterior and posterior dorsal margins. Internal lirae generally 10 in number, sometimes 9 or 11, slightly nodulose at distal ends. Lirae of right valve somewhat more strongly developed. No byssal noteh or ctenolium, lateral gape present.

Remarks. — Other specimens seen from the western Pacific differ slightly from the present material, mainly in coloration (somewhat paler) and in having usually 1 or 2 more internal lirae. The specimens are similar to the type material, although the concentric growth lines are weaker and there are no radial striae on the left valve. *Amussium weberi* is similar in all features, and is interpreted as junior synonym of *Propeamussium caducum*. *P. nakazawai* treated by Oyama (1951), Habe (1958, 1977) and Knudsen (1967) as a synonym of *P. caducum* is a *nomen nudum* (no description and not compared with any other species).

Descriptions of the soft parts, food and reproduction are given by Knudsen (1967: 275). Hayami (1988a) described shell crystallography.

P. caducum is the type species of *Parvamussium (Flavamussium)*. Kuroda & Habe (1981:62) treated *Flavamussium* as a subgenus of, and Hertlein (1969: N350) as a synonym of *Propeamussium*. *P. caducum* is a typical *Propeamussium*.

Source : MNHN, Paris

Propeamussium maorium (Dell, 1956)

Figs 11-14

Parvamussium maorium Dell, 1956: 20, figs 30-31.

Other references:

Parvamussium maorium — Powell, 1979: 381, figs 93.1-2. — Rombouts, 1991: 69.
Parvamussium maorum (*sic*) — Dell, 1962: 75; 1963: 206.

Type material. — Holotype dead-taken, NMNZ M9171, 5 paratypes NMNZ M9169.

Type locality. — Portobello *"Alert"*, stn 54-17, Canyon A, ENE of Taiaroa Head, New Zealand, 476-640 m.

Material examined. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn CP 387, 20°53′ S, 160°52′ E, 650-660 m, 1 spm.
CORAIL 2: stn DE 15, 20°51′ S, 160°56′ E, 580-590 m, 1 lv, 1 rv. — Stn DE 15b, 20°51′ S, 160°55′ E, 580-590 m, 3 lv, 1 rv.
New Caledonia. MUSORSTOM 4: stn CP 169, 18°54′ S, 163°11′ E, 590 m, 1 db.
Loyalty Islands. BIOGEOCAL: stn CP 232, 21°33′ S, 166°27′ E, 760-790 m, 1 lv, 2 rv.
MUSORSTOM 6: stn DW 469, 21°03′ S, 167°34′ E, 630 m, 1 spm. — Stn DW 483, 21°19′ S, 167°47′ E, 600 m, 1 spm.

Distribution. — North and South Islands of New Zealand, Chatham Islands (NMNZ), Kermadec Islands and Norfolk Island (Dijkstra, unpubl. data); now also the Chesterfield Islands and Loyalty Basin. Present material living at 600-660 m.

Description. — *Shell* somewhat inequivalve, fragile, suborbicular, up to ca. 20 mm high, semi-translucent, left valve brighter brownish or creamy than right, umbonal angle about 90°.

Prodissoconch ca. 210 µm in height.

Left valve somewhat more convex than right, covered with prominent, irregularly arranged radial costae, that extend to marginal area; the costae covered with fine lamellae, that become more closely spaced near ventral margin. Auricles small, equal in size, smooth.

Right valve with widely spaced concentric lirae. Auricles unequal, sculptured with fine concentric striae. Small scales produced on hinge line near dorsal margin. Internal lirae generally 10-12, sometimes a few secondary riblets developed between primary riblets near anterior and posterior margins. Resilifer triangular, elongate. Byssal notch small. Lateral gape present, no ctenolium.

Remarks. — The present specimens agree very well with the type material. The closest species is *Propeamussium investigatoris* (E.A. Smith, 1906) from the SE Arabian Sea. The irregularly spaced radial costae and concentric striae commence earlier on the disc of the latter species, whereas *P. maorium* is smooth and glossy at the same stage of growth. Another allied species is *P. jeffreysii* (E.A. Smith, 1885) from the Philippines, which has finer sculpture (somewhat cancellate) on the left valve that extend to the central part of the disc, and prominent concentric lamellae near the ventral margin at maturity.

Although Dell (1956) placed *P. maorium* in *Parvamussium*, it is a typical *Propeamussium*.

Source : MNHN, Paris

Propeamussium meridionale (E.A. Smith, 1885)

Figs 15-18, 143-146

Amussium meridionale E.A. Smith, 1885: 316, pl. 24, figs 1-1a.

Other references:

Amussium meridionale – KNUDSEN, 1967: 277, pl. 1, fig. 16, textfig. 17.
Propeamussium meridionale – GRAU, 1959: 12, pl. 1. — KNUDSEN, 1970: 94, pl. 12, figs 5-9, textfig. 58. — DELL, 1990: 37.
Propeamussium (Propeamussium) meridionale – DIJKSTRA, 1990: 2, 9, pl. 1, figs 1-2.
Varlamussium (sic) meridionale – POWELL, 1960: 175.
Verlamussium (sic) meridionale – CLARKE, 1962: 60.

TYPE MATERIAL. — Lectotype (Figs 143-6, H 13.8, L 13.4, D 4.0 mm) here designated, live taken, BMNH 1887.2.9.3337 (corresponding to the original description and measurements), 2 paralectotypes BMNH 1887.2.9.3335/1-2, undamaged left valve (corresponding to the figured shell from *"Challenger"*, stn 146). Posterior margin of left valve and marginal apron of right valve of the lectotype is somewhat damaged. — *A. meridionale* var. BMNH 1887.2.9.3336/1-4, 3 lv and 1 rv (stn 302) does not belong to the type series according to ICZN art. 72b(i).

TYPE LOCALITY. — *"Challenger"*, stn 158, 50°01′ S, 123° E, southern Indian Ocean, 3292 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. CORAIL 2: stn DW 172, 18°26′ S, 155°12′ E, 1100 m, 1 spm.
New Caledonia. BIOCAL: stn DS 04, 21°15′ S, 166°39′ E, 2340 m, 5 spms, 1 lv. — Stn DW 53, 23°09′ S, 167°42′ E, 975-1005 m, 3 lv. — Stn DW 56, 23°34′ S, 167°11′ E, 695-705 m, 1 rv. — Stn CP 61, 24°11′ S, 167° 31′ E, 1070 m, 3 lv, 4 rv. — Stn CP 63, 24°28′ S, 168°07′ E, 2160 m, 1 spm. — Stn DW 66, 24°55′ S, 168°21′ E, 505-515 m, 1 rv. — Stn DW 70, 23°24′ S, 167°53′ E, 965 m, 4 lv, 1 rv. — Stn DW 80, 20°31′ S, 166°48′ E, 900-980 m, 4 rv. — Stn DS 98, 21°24′ S, 166°29′ E, 2365-2470 m, 3 spms.
MUSORSTOM 4: stn DW 160, 18°42′ S, 163°13′ E, 675 m, 4 lv, 2 rv. — Stn CP 169, 18°54′ S, 163°11′ E, 600 m, 6 lv, 2 rv. — Stn CP 178, 18°56′ S, 163°12′ E, 520 m, 1 lv.
Loyalty Islands. BIOGEOCAL: stn CP 250, 21°24′ S, 166°28′ E, 2350 m, 1 spm. — Stn CP 290, 20°36′ S, 167°03′ E, 920-760 m, 2 spms, 3 lv, 2 rv. — Stn DW 296, 20°38′ S, 167°10′ E, 1230-1270 m, 3 lv, 2 rv. — Stn CP 297, 20°38′ S, 167° 10′ E, 1230-1240 m, 1 spm, 1 lv.
MUSORSTOM 6: stn DW 396, 20°48′ S, 167°00′ E, 1400 m, 3 lv, 1 rv. — Stn DW 397, 20°47′ S, 167°05′ E, 380 m, 1 lv. — Stn DW 488, 20°49′ S, 167°06′ E, 800 m, 4 spms, 37 lv, 29 rv.

DISTRIBUTION. — SMITH (1885) recorded this species from three widely scattered localities: South of Western Australia, East of Marion Island (southern Indian Ocean), and West of Patagonia (southeastern Pacific). KNUDSEN (1967) added several new records from the northern Arabian Sea, Zanzibar area, Maldive Islands, the Gulf of Aden, and the Kermadec area (NE of New Zealand). DIJKSTRA (1990) mentioned a new record from the Flores Sea (Indonesia). Now also the Chesterfield Islands, New Caledonia and the Loyalty Islands. Present material living at 760-2470 m.

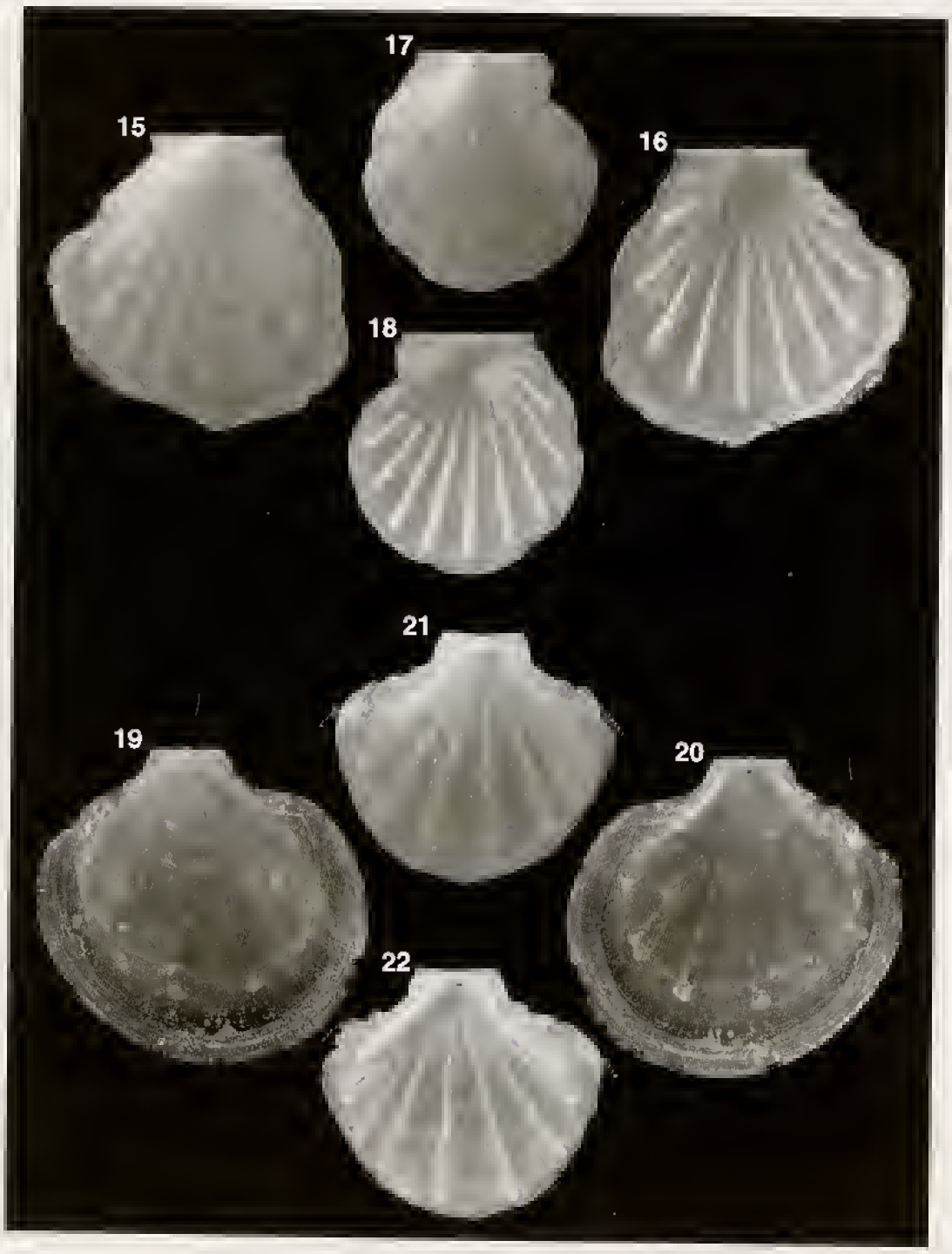
DESCRIPTION. — *Shell* fragile, somewhat inequivalve, nearly circular, up to ca. 15 mm high, left valve slightly more convex than right, auricles equal, pellucid white, umbonal angle about 120°.

Prodissoconch ca. 200 µm in height (KNUDSEN, 1967).

Left valve sculptured with delicate radial lirae, commencing at 3 mm shell length, extending almost to ventral margin. Prominent concentric lamellae extend to ventral margin, intersected by radial lirae to produce a somewhat cancellate sculpture. Auricles equal, sculptured with radial striae. Some delicate lamellae near anterior and posterior margins.

Right valve covered by regular concentric lirae, which are more close-set near margins. Auricles differently sculptured: Anterior auricle with stronger radial lirae than posterior, concentric lamellae near dorsal margin. Interior somewhat iridescent, hyaline near margins. Internal riblets variable in number, generally 12, without distinct terminal nodules. Hinge line straight with delicate scales on dorsal margin. Resilifer triangular. No byssal notch, or ctenolium.

Source : MNHN, Paris



FIGS 15-22. — **15-18**, *Propeamussium meridionale*, MUSORSTOM 6: stn DW 488, 18.0 x 18.5 mm (lv), 14.5 x 14.2 mm (rv). — **15**, left valve, exterior. — **16**, left valve, interior. — **17**, right valve, exterior. — **18**, right valve, interior. **19-22**, *P. sibogai*, MUSORSTOM 6: stn CP 467, 52.1 x 55.1 mm (db). — **19**, left valve, exterior. — **20**, left valve, interior. — **21**, right valve, exterior. — **22**, right valve, interior.

Source : MNHN, Paris

REMARKS. — The present specimens correspond very well with the type material, although the sculpture on the left valves is somewhat more pronounced, while a few (1-3) internal riblets are more strongly developed.

POWELL (1960: 175) placed *P. meridionale* in *Varlamussium*, but all its conchological characters indicate that it is *Propeamussium*.

HICKS & MARSHALL (1985: 227) describe the food of this species.

Propeamussium rubrotinctum (Oyama, 1951)

Figs 23-26

Parvamussium (Parvamussium) rubrotinctum Oyama, 1951: 81, pl. 13, figs 8-10.

Synonym:

Propeamussium (Propeamussium) stella Wang, 1984: 600, 602, pl. 1, figs 11-14. (Syn. nov.)

Other reference:

Propeamussium rubrotinctum – HAYAMI, 1988b: 80.

TYPE MATERIAL. — *P. rubrotinctum*: probably in the private collection of Dr K. OYAMA at Toba (not seen). — *P. stella*: holotype IOAS M25778, paratype IOAS M25779.

TYPE LOCALITY. — *P. rubrotinctum*: Shikoku, Gulf of Tosa, Japan, depth not mentioned, alive?. — *P. stella*: South China Sea, 19° N, 112.5° E, 290 m.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 2, 22°17' S, 167°14' E, 425-430 m, 4 lv. — Stn 3, 22°17' S, 167°12' E, 390 m, 2 lv. — Stn 33, 22°33' S, 166°25' E, 290-350 m, 1 lv.
BIOCAL: stn DW 104, 21°30' S, 166°21' E, 375-450 m, 1 lv.
MUSORSTOM 4: stn DC 235, 22°13' S, 167°12' E, 405-415 m, 5 lv, 2 rv. — Stn DW 244, 22°02' S, 167°08' E, 435-445 m, 2 lv. — Stn CC 246, 22°08' S, 167°11' E, 410-420 m, 4 lv, 4 rv.
Loyalty Islands. BIOGEOCAL: stn DW 253, 21°31' S, 166°28' E, 310-315 m, 1 lv.
MUSORSTOM 6: stn DW 391, 20°47' S, 167°05' E, 390m, 1 lv, 4 rv. — Stn DW 406, 20°40' S, 167°06' E, 373 m, 3 lv, 5 rv. — Stn DW 407, 20°40' S, 167°06' E, 360 m, 1 lv. — Stn CP 408, 20°41' S, 167°07' E, 380 m, 2 spms. — Stn DW 410, 20°38' S, 167°06' E, 490 m, 1 spm, 1 lv, 1 rv. — Stn DW 411, 20°40' S, 167°03' E, 424 m, 11 spms, 22 lv, 13 rv. — Stn DW 412, 20°40' S, 167° 03' E, 437 m, > 50 spms. — Stn DW 413, 20°40' S, 167° 03' E, 463 m, 1 spm, 2 rv. — Stn CP 415, 20°40' S, 167°03' E, 461 m, 4 spms. — Stn DW 416, 20°42' S, 166°59' E, 343 m, 3 rv. — Stn DW 426, 20°24' S, 166° 22' E, 610 m, 1 lv, 1 rv. — Stn DW 428, 20°23' S, 166°12' E, 420 m, 1 spm, 1 rv. — Stn DW 447, 20° 54' S, 167°19' E, 460 m, 1 lv. — Stn DW 458, 21°00' S, 167°29' E, 400 m, 1 rv. — Stn DW 459, 21°01' S, 167° 31' E, 425 m, 1 lv. — Stn CP 464, 21°02' S, 167°31' E, 430 m, 3 lv, 1 rv.

DISTRIBUTION. — OYAMA (1951) recorded this species from Shikoku and Kyushu, Japan. WANG (1984) added a new record from South China Sea. Now also New Caledonia and the Loyalty Islands. Present material living at 380-490 m.

DESCRIPTION. — *Shell* fragile, suborbicular, inequivalve, inequilateral, up to ca. 20 mm high, left valve somewhat more convex than right. Valves gaping at lateral margins. Auricles relatively small, unequal. Umbonal angle about 90°.

Prodissoconch ca. 200 µm in height.

Left valve covered with minute concentric lamellae in late ontogeny near periphery, otherwise smooth and glossy with a few concentric plications, one or two delicate radial plicae near posterior margin. Shell transparent, with light orange patches and small white dots. Auricles smooth. Hinge line straight.

Right valve covered with regular concentric lirae and interstitial microscopic radial scratches. Auricles with concentric striae and somewhat serrated on dorsal margin. Shell whitish, nearly opaque. Internal lirae generally 10, an auricular lira on each side, commencing directly below the resilifer, extending to submarginal area, slightly nodulous at distal ends. Internal lirae of right valve somewhat broader. Resilifer triangular, elongate. Outer ligament rather broad. Adductor scar large, nearly circular, with whitish spots. Small byssal notch, no etenolium.

Source : MNHN, Paris

FIGS 23-30. — **23-26**, *Propeamussium rubrotinctum*, MUSORSTOM 6: stn DW 412, 21.8 x 20.5 mm (db). — **23**, left valve, exterior. — **24**, left valve, interior. — **25**, right valve, exterior. — **26**, right valve, interior. — **27-30**, *P. watsoni*, MUSORSTOM 5: stn CC 367, 47.1 x 47.0 mm (db). — **27**, left valve, exterior. — **28**, left valve, interior. — **29**, right valve, exterior. — **30**, right valve, interior.

Source : MNHN, Paris

REMARKS. — WANG (1984: 603) compared *Propeamussium stella* with *P. caducum*, and observed that these species differ in shape, the number of internal lirae, and in having a glossy surface and a colour pattern, but he overlooked *P. steindachneri* (Sturany, 1901) from the Red Sea and Gulf of Oman, and *P. rubrotinctum* (Oyama, 1951) from Japan. Both of the latter are similar to *P. stella*, although *P. steindachneri* is smaller (ca. 14 mm) and has fewer internal lirae (8), but other shell features are very similar, including the coloration.

OYAMA (1951) placed *P. rubrotinctum* in *Parvamussium s. str.*, but HAYAMI (1988b) indicated that it should be refered to *Propeamussium*, despite its unequal auricles and weakly developed byssal notch.

Propeamussium sibogai (Dautzenberg & Bavay, 1904)

Figs 19-22

Amussium sibogai Dautzenberg & Bavay, 1904: 207, figs 1-4.

Other references:

Amussium sibogai — DAUTZENBERG & BAVAY, 1912: 31, pl. 28, figs 1-4.
Amussium cf. *sibogai* — BARNARD, 1969: 655, pl. 1, figs a-d.
Luteamussium sibogai — OYAMA, 1951: 82, fig. 1. — KIRA, 1967: 138, pl. 49, fig. 14.
Luteamusium (*sic*) *sibogae* (*sic*) — KOSUGE, 1985: 58, pl. 23, fig. 12.
Propeamussium sibogai — KNUDSEN, 1967: 272, pl. 1, figs 23-24. — ABBOTT & DANCE, 1982: 303, fig. — LAMPRELL & WHITEHEAD, 1992: pl. 6, no. 34, fig. 34.
Propeamussium (Propeamussium) sibogai — WANG, 1984: 599, pl. 1, figs 1-2, textfig. 1.

TYPE MATERIAL. — Holotype, live taken, ZMA 3.04.001.

TYPE LOCALITY. — "*Siboga*", stn 12, 7°15' S, 115°15' E, Bali Sea, Indonesia, 289 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DC 381, 19°37' S, 158°46' E, 620 m, 1 rv.
CORAIL 2: stn DE 16, 20°48' S, 160°56' E, 500 m, 1 lv, 1 rv. — Stn DC 169, 18°21' S, 155°20' E, 575 m, 2 rv.
New Caledonia. MUSORSTOM 4: stn CP 169, 18°54' S, 163°11' E, 600 m, 6 spms, 1 rv. — Stn CP 170, 18°57' S, 163°12' E, 485 m, 1 spm.
Loyalty Islands. BIOGEOCAL: stn DW 292, 20°28' S, 166°48' E, 465-470 m, 1 rv. — Stn DW 308, 20°40' S, 166°58' E, 510-590 m, 1 rv.
MUSORSTOM 6: stn DW 410, 20°38' S, 167°06' E, 490 m, 4 spms, 2 lv, 5 rv. — Stn DW 413, 20°40' S, 167°03' E, 463 m, 1 spm. — Stn DW 415, 20°40' S, 167°03' E, 461 m, 2 spms. — Stn CP 464, 21°02' S, 167°31' E, 430 m, 1 spm. — Stn CP 465, 21°03' S, 167°32' E, 480 m, 6 spms, 3 lv, 4 rv. — Stn CP 467, 21°05' S, 167°32' E, 575 m, 2 spms, 4 lv, 4 rv. — Stn DW 487, 21°23' S, 167°46' E, 500 m, 2 lv.
VOLSMAR: stn DW 37, 22°23' S, 168°43' E, 500-550 m, 3 rv.

DISTRIBUTION. — DAUTZENBERG & BAVAY (1912) recorded this species from the Bali Sea (Indonesia). OYAMA (1951), KIRA (1967) and OKUTANI *et al.* (1989) mentioned it from the southern Japanese waters to Indonesia. KNUDSEN (1967) enumerated several records from Indonesia, the Philippines, the Arafura Sea, and off Durban (S. Africa). KOSUGE (1985) added a new record from the Timor Sea (Northwestern Australia). Now this species is also known from New Caledonia and the Loyalty Islands. Present material living at 430-575m. KNUDSEN (1967) indicated a broader vertical range (183-710 m).

DESCRIPTION. — *Shell* fragile, nearly orbicular, inequivalve, somewhat inequilateral, oblique, up to ca. 55 mm high, left valve slightly more convex than right, gaping rather strongly, transparent, auricles rather small and equal in size, umbonal angle about 125°; left valve creamy brown, the right cream coloured.

Prodissoconch ca. 210 µm in height (KNUDSEN, 1967).

Left valve covered with a few delicate concentric growth

Source : MNHN, Paris

lines, a few minute concentric lamellae sometimes present near ventral margin. Delicate radial lirae developed near posterior margin. Auricles smooth and somewhat raised on lateral margins. Hinge line straight. Internal lirae generally 8, deep brown on left valve, whiter and broader on right. Marginal lirae with 4 or 5 small nodules that are visible through lateral gape.

Right valve covered with widely spaced concentric lirae that are much weaker at periphery, and microscopic interstitial granules. Marginal apron of right valve often missing due to the very thin layer of prismatic calcite (HAYAMI, 1988a: fig. 4). Auricles smooth. Resilifer triangular, elongate. No byssal notch, or ctenolium.

REMARKS. — The present material is very similar to the holotype from the Bali Sea, although they have 1 or 2 additional internal riblets.

DAUTZENBERG & BAVAY (1904) incorrectly indicated the type locality as "Celebes Sea", which they subsequently corrected (1912: 31).

P. sibogai is the type species of *Luteamussium*, which was treated by HERTLEIN (1969: N350) as a synonym of *Propeamussium*. Indeed, *P. sibogai* is a typical *Propeamussium*.

Descriptions of the soft parts, reproduction and food are given by KNUDSEN (1967: 272).

Propeamussium watsoni (E.A. Smith, 1885)

Figs 27-30, 123-124

Amussium watsoni E.A. Smith, 1885: 309, pl. 22, figs 8-8c.

Synonym:

Propeamussium watsoni bayonnaisense Okutani, 1962: 15-16, pl. 2, figs 1-2; 1966: 8.

Other references:

Amussium alcocki – THIELE & JAECKEL, 1931: 8.
Amussium watsoni – CLARKE, 1962: 61. — KNUDSEN, 1967: 280, pl. 1, fig. 18.
Propeamussium watsoni – KISELEVA, 1971: 221. — ABBOTT & DANCE, 1982: 303, fig. — HAYAMI, 1988a: 476, figs 2-6.

TYPE MATERIAL. — *A. watsoni*: lectotype (Figs 123-4, H 51.8, L 50.0, D 9.5 mm), here designated, BMNH 1887.2.9.3307, 2 paralectotypes BMNH 1887.2.9.3308/1-2. — *P. watsoni bayonnaisense*: holotype, alive, NSMT Mo.62759 and 5 paratypes NSMT Mo.62760.

TYPE LOCALITY. — *A. watsoni*: *"Challenger"*, stn 218, 2°23′ S, 144°04′ E, NE of New Guinea, alive, 1957 m. — *P. watsoni bayonnaisense*: 24 miles off Bayonnaise Rocks, 32°00.0′ N, 140°21.4′ E, Japan, 2140-2160 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DC 321, 21°20′ S, 158°02′ E, 1000 m, 1 lv, 2 rv. — Stn CP 323, 21°18′ S, 157°57′ E, 970 m, ca. 90 spms. — Stn CP 324, 21°15′ S, 157°51′ E, 970 m, 32 spms. — Stn CC 365, 19°42′ S, 158°48′ E, 710 m, 3 spms. — Stn CC 366, 19°45′ S, 158°45′ E, 650 m, 1 spm. — Stn CC 367, 19°36′ S, 158°53′ E, 830-855 m, 25 spms. — Stn CC 383, 19°40′ S, 158°46′ E, 600-615 m, 1 rv.
New Caledonia. BIOCAL: stn CP 30, 23°08′ S, 166°40′ E, 1140 m, 1 spm. — Stn CP 31, 23°07′ S, 166°50′ E, 850 m, 15 spms. — Stn CP 75, 22°18′ S, 167°23′ E, 825-860 m, 4 spms.
Loyalty Islands. MUSORSTOM 6: stn CP 427, 20°23′ S, 166°20′ E, 800m, 13 spms. — Stn CP 438, 20°23′ S, 166°20′ E, 780 m, 42 spms, 2 rv.
Philippines. MUSORSTOM 2: stn 69, 14°06′ N, 120°03′ E, 1800-1950 m, 2 spms.

DISTRIBUTION. — SMITH (1885) described this species from NE of New Guinea, and subsequently recorded it from the Bay of Bengal and Laccadive Sea. THIELE & JAECKEL (1931) recorded it from the Gulf of Aden, and OKUTANI (1962) from SE Japan. KNUDSEN (1967) enumerated records from the Arabian Sea, Zanzibar area and the Strait of Malacca. KISELEVA (1971) added a new

Source : MNHN, Paris

record from the Red Sea. This species is also found in the Chesterfield Islands, New Caledonia and the Loyalty Islands. Present material living at 650-1140 m.

DESCRIPTION. — *Shell* inequivalve, nearly circular, ca. 60 mm high, slightly higher than wide, somewhat inequilateral, umbonal angle ca. 125°, opaque, left valve milky-white, right valve creamy.

Prodissoconch ca. 240 µm in height.

Left valve more convex than right, with concentric lamellae near the ventral margin and delicate radial lirae that commence at ca. 3 mm shell length and extend to central part of disc, lamellae and lirae variable. Auricles equal, concentric lamellae prominent on anterior, finer and more closely-set on posterior. Generally 10 interior lirae and a small auricular lira on each side, commencing just below resilifer and extending to pallial line.

Right valve with fine regularly concentric lirae and granulate interstitial microsculpture (prismatic calcite layer). Auricles with concentric lirae, anterior auricle with a few radial lines near suture, absent on posterior auricle. Prominent scales on anterior and posterior dorsal margins of auricles. Resilifer triangular, erect. No byssal notch, or ctenolium.

REMARKS. — The present specimens are similar to the type material in shape, sculpture and coloration, although the concentric lirae of the left valve commence closer to the ventral margin, and the radial lirae are somewhat more delicate. Both of the latter two characters are variable.

I follow KNUDSEN (1967: 281) in interpreting *P. watsoni bayonnaisense* as a form of *P. watsoni*.

Genus *PARVAMUSSIUM* Sacco, 1897

Parvamussium Sacco, 1897a: 102. Proposed as a subgenus of *Amussium* Herrmannsen, 1846 (unjustified emendation of *Amussium* Röding, 1798); no diagnosis given, but type species designated; SACCO, 1897b: 48 (diagnosis). Type species (OD): *Pecten (Pleuronectes) duodecimlamellatus* Bronn, 1832; Upper Miocene, northern Italy.

Synonyms:

Variamussium Sacco, 1897a: 102. Proposed as a subgenus of *Amussium*; no diagnosis given, but type species designated. SACCO, 1897b: 49 (diagnosis). Type species (OD): *Amussium cancellatum* E.A.Smith, 1885; Recent, off Bermuda, W Atlantic, 796 m.

Ctenamussium Iredale, 1929: 164. Type species: *Amussium thetidis* Hedley, 1902; Recent, off New South Wales, Australia, 115-137 m.

Glyptamussium Iredale, 1939: 370. Type species (OD): *Amussium torresi* E.A.Smith, 1885; Recent, E of Cape York, Queensland, Australia, 283 m.

Squamamussium Oyama, 1944: 245. Proposed as a subgenus of *Propeamussium*. Type species (OD): *Amussium squamigerum* E.A.Smith, 1885; Recent, off E Puerto Rico, West Indies, 713 m.

Polynemamussium Habe, 1951: 72. Proposed as a subgenus of *Parvamussium*. Type species (OD): *Pecten minuscostatus* Yokoyama, 1920; Pleistocene, Miura City, Kanagawa Prefecture, Japan.

DIAGNOSIS. — *Shell* inaequivalve, orbicular to oblique, usually small to ca. 20 mm, laterally compressed, lateral gape absent; *left valve* usually strongly sculptured with radial and/or concentric riblets or striae, *right valve* with concentric lamellae; auricles unequal; byssal notch well-developed; no ctenolium; internal lirae extend to submarginal or marginal region.

DISTRIBUTION. — Cretaceous to Recent. Worldwide, living in 18-2110 m.

REMARKS. — The characters separating *Parvamussium* from *Propeamussium* are summarized in Table 1.

GRAU (1959: 15) and subsequently HERTLEIN (1969: N350) treated *Parvamussium* as a subgenus of *Propeamussium* and enumerated *Variamussium*, *Ctenamussium*, *Glyptamussium*, *Xenamussium*, *Squamamussium*, *Polynemamussium*, *Bathymussium* and *Micramussium* as synonyms of *Parvamussium*. HERTLEIN (1969: N350) also mentioned in the synonymy "*Graptamussium* Oyama, 1944", which is an error for *Glyptamusium*. *Bathymussium* and *Micramussium* are here considered synonyms of *Propeamussium*, and *Xenamussium* a synonym of *Cyclopecten*.

Source : MNHN, Paris

Parvamussium multiliratum sp. nov.

Figs 31-34, 91-92

TYPE MATERIAL. — Holotype MNHN. Paratypes: 11 MNHN, 1 AMS C201711, 1 IID, 1 USNM.

TYPE LOCALITY. — Southern New Caledonia, BIOCAL, stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m.

MATERIAL EXAMINED. — **New Caledonia.** BIOCAL: stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m, 2 spm. 1 lv (holotype and paratypes).
Loyalty Islands. BIOGEOCAL: stn KG 240, 21°29′ S, 166°27′ E, 1520 m, 1 rv (paratype). — Stn CP 243, 21°28′ S, 166°26′ E, 1820 m, 1 lv (paratype). — Stn CP 260, 21°00′ S, 167°58′ E, 1820-1980 m, 2 spms (paratypes). — Stn CP 272, 21°00′ S, 166°57′ E, 1615-1710 m, 1 spm (paratype). — Stn CP 273, 21°02′ S, 166°57′ E, 1920-2040 m, 5 spms (paratypes: 1 HD, 1 AMS, 2 MNHN, 1 USNM). — Stn CP 317, 20°48′ S, 166°53′ E, 1620-1630 m, 1 lv, 1 rv (paratypes).

DISTRIBUTION. — New Caledonia, 1520-2110 m, living in 1615-2110 m.

DESCRIPTION. — *Shell* rather small, fragile, orbicular, inequivalve, semi-transparent white, up to ca. 9 mm high, left valve slightly more convex than right, auricles subequal, umbonal angle about 110°.

Prodissoconch ca. 220 µm in height.

Left valve sculptured with widely spaced concentric lamellae that commence at 3 mm shell height, and extend to ventral margin. Irregularly spaced, delicate radial riblets arising near submarginal region, a few commencing earlier. Umbonal region glossy with some white spots, otherwise transparent and dull due to microscopic granules. Auricles with concentrically lamellate riblets that are closer near lateral margins.

Right valve with regularly spaced concentric lirae, somewhat interrupted near submarginal region by a disturbance of growth. Auricles with concentric lamellae that are somewhat stronger on anterior, and more closely spaced on posterior. Hinge line straight, with some scales near margins,that are more prominent on anterior. Byssal fasciole small. Each valve with 14 internal lirae plus 2 rudimentary interstitial lirae; one auricular lira on both auricles. External sculpture clearly visible from the interior. Resilifer triangular. Byssal notch present, no ctenolium.

Dimensions of the holotype: H 7.9, L 8.9, D 2.4 mm.

REMARKS. — The most closely related species is *Parvamussium permirum* (Dautzenberg, 1925) recorded from the Bay of Biscay (E Atlantic) and adjacent abyssal depths. *P. permirum* has more regularly spaced radial riblets on the left valve, and fewer concentric lamellae. Internal lirae generally 12 with 2-4 additional rudimentary interstitial lirae and the hinge line has fewer scales. *P. retiaculum* is somewhat similar to *P. multiliratum* in sculpture, although the latter has fewer radial riblets, and a more strongly orbicular shape, with more numerous internal lirae. DAUTZENBERG (1925: 11) placed *P. permirum* in *Amussium (Varianussium)*, but all the conchological characters are similar to *Parvamussium*.

ETYMOLOGY. — So named because the internal lirae are more numerous than usual for a propeamussiid (Lat. *liratus*, adj. = with lira(e)).

Parvamussium pauciliratum (E.A. Smith, 1903)

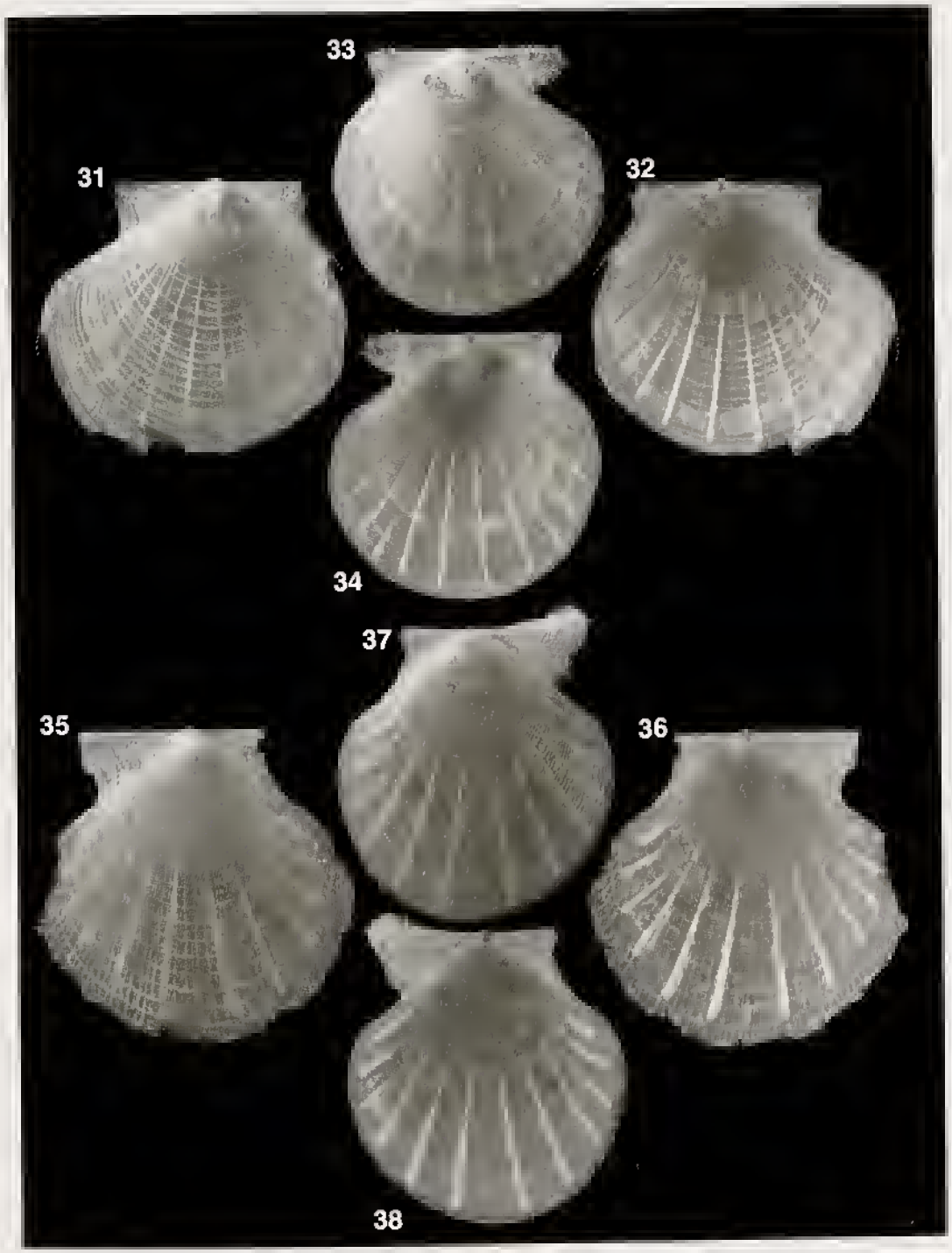
Figs 107-110, 151-152

Amussium paucilirata E.A. Smith, 1903: 622, pl. 36, figs 23-24.

Other reference:

Parvamussium pauciliratum — DIJKSTRA, 1991: 14, figs 23-24.

Source : MNHN, Paris



FIGS 31-38. — **31-34**, *Parvamussium multiliratum*, holotype, 7.9 x 8.9 mm (db). — **31**, left valve, exterior. — **32**, left valve, interior. — **33**, right valve, exterior. — **34**, right valve, interior. — **35-38**, *P. retiaculum*, holotype, 7.3 x 7.2 mm (db). — **35**, left valve, exterior. — **36**, left valve, interior. — **37**, right valve, exterior. — **38**, right valve, interior.

Source : MNHN, Paris

TYPE MATERIAL. — Lectotype (Figs 151-2, H 7.5, L 7.4, D 2.0 mm), here designated, live taken, BMNH 1903.9.17.17; 2 paralectotypes BMNH 1903.9.17.18/1-2. Although the original registration number indicated 4 specimens, only three syntypes are now present.

TYPE LOCALITY. — S Nilandu Atoll, Maldive Islands, 2-66 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DW 263, 25°21′ S, 159°46′ E, 150-225 m, 1 lv, 1 rv.
New Caledonia. LAGON: stn 348, 22°42′ S, 166°55′ E, 45 m, 1 lv. — Stn 622, 22°02′ S, 166°53′ E, 67 m, 1 rv. — Stn 698, 21°29′ S, 166°09′ E, 40-43 m, 1 spm. — Stn 729, 21°19′ S, 165°54′ E, 42-45 m, 1 spm. — Stn 853, 20°41′ S, 165°07′ E, 27 m, 1 rv. — Stn 873, 20°39′ S, 164°46′ E, 27 m, 1 spm. — Stn 1191, 19°35′ S, 163°38′ E, 45 m, 1 spm.

DISTRIBUTION. — This is a shallow-water species, which is included here for a comprehensive treatment of the Propeamussiidae of New Caledonia. Beside the type locality, the Maldive Islands, it has been recorded from Indonesia by DIJKSTRA (1991). Present material from New Caledonia alive in 27-45 m. Also shells in the Chesterfield Islands in 150-250 m.

DESCRIPTION. — *Shell* rather small, semi-transparent, whitish, sub-orbicular, inequivalve, up to ca. 8 mm high, auricles nearly equal in size, right valve more convex than left, umbonal angle about 105°.

Prodissoconch ca. 200 µm in height.

Left valve glossy, with a few minute growth lines and covered with microscopic granules. Auricles smooth, sometimes [see Remarks] with delicate concentric lirae near anterior margin.

Right valve glossy, smooth, apart from microscopic granules. Anterior auricle with minute concentric lirae. Hinge line straight.

Internal lirae rudimentary, 1 or 2, usually a small auricular lira on each side. Outer ligament well developed. Left valve creamy-white, stained with white dots, right valve transparent-white. Resilifer triangular. Byssal notch very small, no etenolium.

REMARKS. - The present specimens are similar in all aspects to the type material from the Maldive Islands, although microsculpture is sometimes variable. The New Caledonian specimens, which are from shallower depths, sometimes have microscopic divergent scratches near the postero-dorsal margin on the left valve. Microscopic granules are generally present on both valves. Juveniles often lack the internal rudimentary lirations.

Parvamussium retiaculum sp. nov.

Figs 35-38

TYPE MATERIAL. Holotype MNHN. Paratypes: 25 MNHN, 2 AMS C201712, 2 HD, 2 NMNZ M268536, 2 NSMT, 2 USNM.

TYPE LOCALITY. — Southern New Caledonia, BIOCAL, stn DW 51, 23°05′ S, 167°45′ E, 680-700 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 33, 23°10′ S, 167°10′ E, 675-680 m, 2 lv (paratypes). — Stn DW 36, 23°09′ S, 167°11′ E, 650-680 m, 2 lv (paratypes). — Stn DW 48, 23°00′ S, 167°29′ E, 775 m, 2 lv (paratypes). — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 7 spms, 8 lv, 15 rv (holotype and paratypes: 2 AMS, 2 HD, 19 MNHN, 2 NMNZ, 2 NSMT, 2 USNM).

DISTRIBUTION. — Southern New Caledonia 650-775 m, living 680-700 m.

DESCRIPTION. — *Shell* small, fragile, suborbicular, inequivalve, up to ca. 7 mm high, left valve slightly more convex than right, semi-transparent white, auricles of unequal size, umbonal angle about 100°.

Prodissoconch ca. 210 µm in height.

Left valve sculptured with 14 prominent, widely spaced, concentric lamellae, starting weakly at ca. 2 mm shell height, extending to ventral margin. Delicate, regularly spaced radial riblets, commence at about 3 mm shell height, and extend to

Source : MNHN, Paris

ventral margin. Exterior of disc with semi-reticulated sculpture produced by concentric lamellae and intersecting radial riblets. Anterior auricle stronger than posterior sculptured with close-set, irregularly spaced concentric lamellae; posterior auricle with identical though weaker sculpture. Hinge line straight.

Right valve with regularly spaced concentric lirae, close-set near umbonal area and becoming more widely spaced toward ventral margin. Anterior auricle more strongly sculptured near lateral margin with concentric lamellae. Hinge line somewhat elevated due to strong concentric lamellae. Byssal fasciole present.

Each valve with 12 internal lirae and 1 auricular lira that commence rather late and extend to near the periphery; one rudimentary interstitial lira on left valve near the ventral margin. Outer ligament well developed and rather broad on posterior auricle. Small byssal notch, no ctenolium.

Dimensions of the holotype: H 7.3, L 7.2, D 1.9 mm.

REMARKS. — *P. retiaculum* is somewhat similar to *P. multiliratum*, although the latter is slightly larger and more orbicular, while the auricles are more equal and smaller, fewer radial riblets are developed on the left valve, there are more internal lirae, and the hinge line of the right valve is straight. *P. multiliratum* lives at much great depths (lower bathyal to upper abyssal).

The right valve of *P. torresi* is somewhat similar to that in *P. retiaculum*, although the internal lirae commence earlier, and are fewer in number (generally 10). Moreover, the left valve of *P. torresi* is glossy and nearly smooth, whereas *P. retiaculum* is prominently sculptured and dull.

The left valve of *P. thetidis* is covered with prominent irregularly spaced, radial costae and delicate close-set concentric lamellae, whereas *P. retiaculum* has prominent concentric lamellae, and delicate radial riblets.

ETYMOLOGY. — From the cancellate sculpture of the left valve (Lat. *retiaculum*, n. = net, lattice-work, wattle-work).

Parvamussium retiolum sp. nov.

Figs 39-42, 97

TYPE MATERIAL. — Holotype MNHN. Paratypes: 36 MNIIN, 2 AMS C201713, 2 HD, 2 NMNZ M268537, 2 NSMT, 2 USNM.

TYPE LOCALITY. — Chesterfield Islands, MUSORSTOM 5, stn CP 363, 19°47′ S, 158°44′ E, 685-700 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 340, 19°48′ S, 158°40′ E, 675-680 m, 1 spm, 1 lv, 3 rv. — Stn DW 341, 19°45′ S, 158°43′ E, 620-630 m, 5 spms, 3 lv, 3 rv. — Stn DC 357, 19°37′ S, 158°45′ E, 630 m, 2 lv, 2 rv. — Stn DC 358, 19°38′ S, 158°47′ E, 680-700 m, 4 spms, 1 lv, 5 rv. — Stn CP 363, 19°47′ S, 158°44′ E, 685-700 m, 41 spms, 6 lv (holotype and paratypes). — Stn CP 364, 19°45′ S, 158°46′ E, 675 m, 1 spm. — Stn DC 380, 19°37′ S, 158°43′ E, 555-570 m, 1 lv.
New Caledonia. BIOCAL: stn DW 56, 23°34′ S, 167°11′ E, 695-705 m, 1 lv, 7 rv.
MUSORSTOM 4: stn CP 158, 18°49′ S, 163°15′ E, 620 m, 1 lv. — Stn DC 168, 18°48′ S, 163°10′ E, 720 m, 1 spm.

DISTRIBUTION. — New Caledonia and Chesterfield Islands, 555-720 m, living 620-720 m.

DESCRIPTION. — *Shell* rather small, inequivalve, inequilateral, up to ca. 16 mm high, left valve somewhat more convex than right, translucent white, auricles unequal, umbonal angle about 95°.

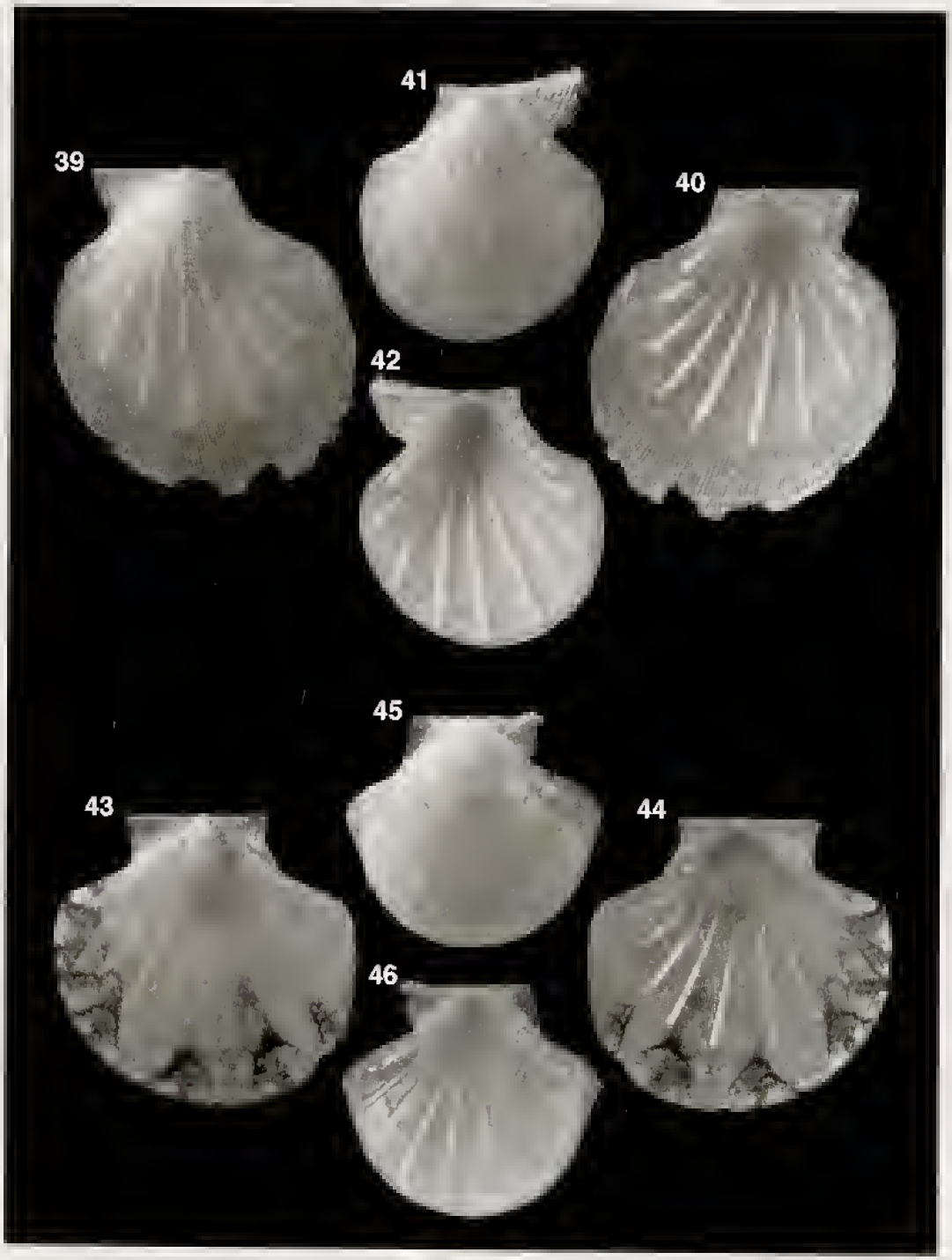
Prodissoconch ca. 220 µm in height.

Left valve covered with delicate concentric lamellae crossing closely spaced radial riblets, somewhat coarser near umbonal area, finer near ventral margin. Anterior auricle well developed, with many fine radial riblets that are crossed near margin by fine concentric lamellae; posterior auricle similary sculptured. Hinge line straight.

Right valve with regular concentric lirae, closely spaced near umbonal area, becoming more widely spaced towards the ventral margin. Microscopic interstitial radial scratches near margins. Auricles strongly developed, with concentric lamellae that are more prominent anteriorly. Strongly developed scales on antero-dorsal margin.

Internal lirae 10, plus 1 posterior auricular lira and 4 rudi-

Source : MNHN, Paris



FIGS 39-46. — **39-42**, *Parvamussium retiolum*, holotype, 16.0 x 14.8 mm (db). — **39**, left valve, exterior. — **40**, left valve, interior. — **41**, right valve, exterior. — **42**, right valve, interior. — **43-46**, *P. scitulum*, MUSORSTOM 6: stn DW 462, 10.9 x 11.4 mm (db). — **43**, left valve, exterior. — **44**, left valve, interior. — **45**, right valve, exterior. — **46**, right valve, interior.

Source : MNHN, Paris

mentary auricular lirae on left valve and 3 on right, ends nodose. Resilifer triangular, elongate. Strongly developed outer ligament near resilifer. Byssal notch small, no ctenolium. Dimensions of the holotype: H 16, L 14.8, D 3.5 mm.

REMARKS. — *Parvamussium retiolum* is somewhat similar to *P. thetidis*, which also occurs in the study area (see below). *P. retiolum* is larger, with a fine cancellate sculpture on left valve; the latter species has irregularly spaced, strong radial costae crossed by delicate concentric lamellae. Auricles and right valve of *P. retiolum* more sculptured with closely spaced, concentric lamellae. Internal lirae variable, somewhat similar to *P. thetidis*.

Parvamussium retiolum differs from *P. retiaculum* in its more delicate cancellate sculpture on left valve, and in having more closely spaced, concentric lamellae on right valve. Internal lirae of *P. retiolum* start earlier.

In all aspects *P. retiolum* is representative of *Parvamussium*.

ETYMOLOGY. — From the cancellate sculpture of the left valve (Latin *retiolum*, n. = small net).

Parvamussium scitulum (E.A. Smith, 1885)

Figs 43-46, 153-154

Amussium scitulum E.A. Smith, 1885: 312, pl. 23, figs 4-4b.

Synonym:

Amussium (Propeamusium) (sic) scitulum var.? *cmadoritinctum* Kuroda, 1931: 77, figs 81-82.

Other references:

Ctenamusium (Ctenamusium) cmadoritinctum — OYAMA, 1951: 80, pl. 13, figs 3-4.
Ctenamussium (sic) cmadoritinctum — HABE, 1964: 173, pl. 53, fig. 4.
Ctenamussium (sic) scitulum — KURODA & HABE, 1981: 63.
Propeamussium cmadoritinctum — HAYAMI, 1988a: 479, figs 2-1,2.
Propeamussium (Parvamussium) scitulum — DIJKSTRA, 1990: 3.
Parvamussium scitulum — DIJKSTRA, 1991: 16, figs 35-43.

TYPE MATERIAL. — *A. scitulum*: lectotype (Figs 153-4, left valve: H 4.4, L 4.5 mm), here designated BMNH 1887.2.9.3319/1; 6 paralectotypes BMNH 1887.2.9.3319/2-7. — *A. scitulum* var. *cmadoritinctum*: Kikuchi Shell Museum, Kuroda coll. (not seen).

TYPE LOCALITY. — *A. scitulum*: *"Challenger"*, stn 188, 9°59′ S, 139°42′ E, S of New Guinea, dead, 51m. — *A. scitulum* var. *cmadoritinctum*: Yakushima Island, Kagoshima Prefecture, Kyushu, Japan.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 258, 25°32′ S, 159°46′ E, 300 m, 1 spm. — Stn DW 270, 24°48′ S, 159° 34′ E, 223 m, 3 lv, 3 rv. — Stn DW 285, 24°09′ S, 159°34′ E, 245-255 m, 1 lv. — Stn DW 296, 23°12′ S, 159°36′ E, 278 m, 1 lv.
New Caledonia. *"Vauban"*1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 17 lv, 21 rv.
BIOCAL: stn DW 64, 24°48′ S, 168°09′ E, 250 m, 3 spms, 3 lv.
SMIB 5: stn DW 96, 23°00′ S, 168°19′ E, 245 m, 1 lv.
Loyalty Islands. MUSORSTOM 6: stn DW 462, 21°05′ S, 167°26′ E, 200 m, 3 spms, 4 lv, 1 rv.

DISTRIBUTION. — SMITH (1885) described this species from the southern area of New Guinea. KURODA (1931) mentioned it from Japanese waters, whereas KURODA & HABE (1981) recorded a larger distribution from Honshu (Japan) to Indonesia. DIJKSTRA (1990, 1991) summarized several records from the Indonesian Archipelago. Now it is also known from the New Caledonian region. Present material living at 200-300 m.

Source : MNHN, Paris

DESCRIPTION. — *Shell* rather small, sub-orbicular, compressed, inequivalve, inequilateral, right valve more convex than left, up to ea. 10 mm high, right valve semi-transparent white, left valve stained and opaque, auricles rather small and subequal, umbonal angle about 120°.

Prodissoconch ea. 210 µm in height.

Left valve flat, weakly seulptured with delieate, variable radial striations, somewhat stronger near posterior margin. Mieroseopie close-set eoneentrie striae sometimes developed on disc, somewhat more widely spaeed near umbonal area. Anterior auriele with prominent eoneentrie lamellae close to flank of dise, deereasing in prominence or absent near antero-dorsal margin; posterior auriele eovered with fine radial and eoncentrie striations, sometimes nearly absent.

Right valve either weakly sculptured with a few growth lines or completely smooth. Internal lirae extending to submarginal area, and generally 9 or 10, sometimes with 1 or 2 rudimentary interstitial lirae. Resilifer triangular. Hinge line straight. Byssal noteh present, no ctenolium.

REMARKS. — The present specimens are similar to the type material, although larger in size. SMITH (1885: 312) suggested that the syntypes of *P. scitulum* could be juveniles, which wotild seem to be the case. Sculpture and coloration are rather variable. *P. cmadoritinctum* has slighily stronger sculpture, but is otherwise similar to the present specimens. *Parvamussium sinense* Wang, 1980 (: 259), from the East China Sea, is somewhat broader, with stronger, scaly radial costae.

OYAMA (1951: 80) used the genus *Ctenamusium* for this species, but the shell characters are typical of *Parvamussium*, as indicated by HERTLEIN (1969).

Parvamussium squalidulum sp. nov.

Figs 47-50

TYPE MATERIAL. — Holotype MNHN. Paratypes: 2 AMS C201714, 3 HD, 6 MNHN, 2 USNM.

TYPE LOCALITY. — Lord Howe Rise, Kelso Bank, MUSORSTOM 5, stn DW 277, 24°11' S, 159°35' E, 270 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 255, 25°15' S, 159°55' E, 280-295 m, 1 lv, 2 rv. — Stn DW 258, 25° 33' S, 159°46' E, 300 m. 7 lv, 3 rv. — Stn DW 260, 25°29' S, 159°44' E, 285 m, 1 lv. — Stn DW 261, 25°27' S, 159°46' E, 300 m, 2 rv. — Stn CP 268, 24°45' S, 159°39' E, 280 m, 4 lv. — Stn CP 269, 24°47' S, 159°37' E, 250-270 m, 1 lv. — Stn DW 272, 24°41' S, 159°43' E, 500-540 m, 1 lv, 3 rv. — Stn DW 274, 24°45' S, 159°41' E, 285 m, 1 lv. — Stn DW 277, 24°11' S, 159°35' E, 270 m, 4 spms, 2 lv, 8 rv (holotype and paratypes: 2 AMS, 3 HD, 6 MNHN, 2 USNM). — Stn CP 279, 24°09' S, 159°38' E, 260-270 m, 6 lv, 1 rv. — Stn DW 299, 24°48' S, 159° 24' E, 360-390 m, 2 lv, 3 rv. — Stn DW 301, 22°07' S, 159°25' E, 487-610 m, 1 lv.
Loyalty Islands. MUSORSTOM 6: stn DW 480, 21°08' S, 167°56' E, 380 m, 1 lv, 1 rv.
New Hebrides Arc[1]. VOLSMAR: stn DW 7, 22°26' S, 171°44' E, 325-400 m, 1 spm, 1 lv. — Stn DW 17, 22°23' S, 171°41' E, 260-300 m, 1 lv.

DISTRIBUTION. — Chesterfield Islands, New Caledonia to the New Hebrides Arc; shells in 260-610 m, alive in 260-400 m.

DESCRIPTION. — *Shell* rather small, suborbieular, inequivalve, inequilateral, semi-transparent, up to ea. 11 mm high, left valve slightly more convex than right; auricles rather small, unequal; umbonal angle about 125°.

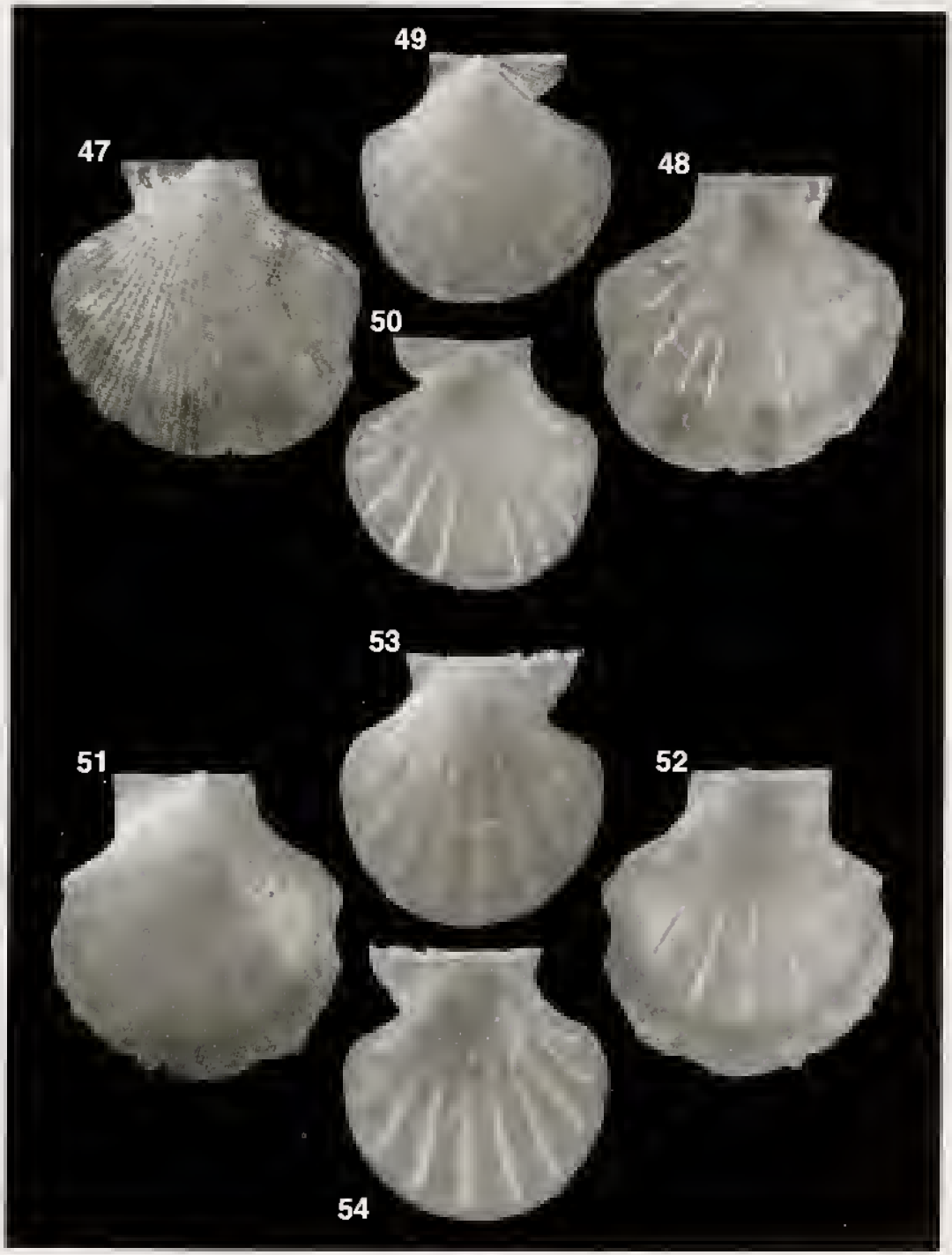
Prodissoconch ea. 210 µm in height.

Left valve with numerous irregularly spaeed, sealy radial costae, a few eommencing weakly at about 1 mm shell height, inereasing in number towards the ventral margin; small delicate eoneentrie lamellae developing between them, more elosely spaeed near ventral margin. Anterior auriele well developed, posterior rather small. Three very weak radial lirae on anterior auriele, absent on posterior. Both auricles covered with concentric lamellae. Hinge line straight.

Right valve with minute eoneentrie lirae near the lateral margin, absent from central region of dise. Marginal apron (outer prismatie ealeite layer) mostly broken off, covered with fine concentrie lirae (marginal region below the internal lirae). Anterior auriele well developed, provided with 5 radial riblets that are covered with eon-eentrie lamellae, stronger on dorsal margin. Posterior auriele with delicate lamellae.

[1] Although the eondominium of the New Hebrides has become independant under the name of Vanuatu, the term New Hebrides is retained here to designate the Hunter and Matthew area of the New Hebrides Are. Hunter and Matthew are a dependeney of New Caledonia. Similarly, geographers and geophysicists have retained the expression New Hebrides Treneh.

Source : MNHN, Paris



FIGS 47-54. — **47-50**, *Parvamussium squalidulum*, holotype, 11.1 x 11.4 mm (db). — **47**, left valve, exterior. — **48**, left valve, interior. — **49**, right valve, exterior. — **50**, right valve, interior. — **51-54**, *P. torresi*, MUSORSTOM 5: stn DW 329, 9.0 x 8.9 mm (lv), 7.9 x 7.7 mm (rv). — **51**, left valve, exterior. — **52**, left valve, interior. — **53**, right valve, exterior. — **54**, right valve, interior.

Source : MNHN, Paris

Ten irregularly spaced internal lirae, plus 2 rudimentary lirae. One auricular lira on posterior auricle, absent on anterior. External sculpture and coloration slightly visible internally. Resilifer triangular. Byssal notch present, no ctenolium. Left valve creamy, with white and orange-brown maculations, right valve semi-transparent white and glossy.

Dimensions of the holotype: H 11.1, L 11.4, D 2 mm.

REMARKS. — The closest species is *Parvamussium sinense*, the left valve of which is more strongly sculptured with closely spaced scaly radial costae than in *P. squalidulum*. The latter is slightly more orbicular, and the right valve is covered with delicate concentric lirae, which are absent in *P. sinense*. The internal lirae of *P. sinense* are more regularly spaced with more stronger developed terminal nodules at the distal ends. Another related species is *P. scitulum*, the left valve of which is more delicately sculptured with close-set radial striae (sometimes absent), while concentric lirae are also absent on the right valve. *P. squalidulum* is slightly more convex than *P. scitulum*.

ETYMOLOGY. — From numerous scaly radial costae of the exterior of the left valve (Latin *squalidulus*, adj. = with small scales).

Parvamussium texturatum (Dautzenberg & Bavay, 1912)

Figs 103-106

Amussium texturatum Dautzenberg & Bavay, 1912: 37, pl. 27, figs 19-22.

Other reference:

Parvamussium cf. *texturatum* — DIJKSTRA, 1991: 17, figs 44-52.

TYPE MATERIAL. — Holotype, live taken, ZMA 3.12.022.

TYPE LOCALITY. — Sulu Archipelago. *"Siboga"*, stn 105, 6°08′ N, 121°19′ E, 275 m.

MATERIAL EXAMINED. — The type material.

Chesterfield Islands. MUSORSTOM 5: stn DW 300, 22°48′ S, 159°24′ E, 450 m, 2 spms.

New Caledonia. BIOGEOCAL: stn DW 308, 20°40′ S, 166°58′ E, 510-590 m, 4 lv.

Loyalty Islands. MUSORSTOM 6: stn DW 417, 20°42′ S, 167°04′ E, 283 m, 1 lv. — Stn DW 456, 21°01′ S, 167°26′ E, 240 m, 1 lv, 2 rv. — Stn DW 461, 21°06′ S, 167°26′ E, 240 m, 1 spm.

DISTRIBUTION. — Beside the type locality in the Sulu archipelago (Philippines), somewhat similar specimens were recorded by DIJKSTRA (1991) from Indonesia. Now it is also known from the Chesterfield Islands, New Caledonia and the Loyalty Islands. Present material live collected in 240-450 m.

DESCRIPTION. — *Shell* small, suborbicular, inequivalve, inequilateral, nearly opaque, up to ca. 5 mm high, left valve slightly more convex than right, auricles unequal in size, umbonal angle about 95°. Left valve creamy white, sometimes stained with few white and brown spots, right valve whitish.

Prodissoconch ca. 200 µm in height.

Left valve sculptured with strongly developed, irregularly-spaced radial costae, starting at 1-2 mm shell height and enlarging towards ventral margin. Regularly spaced concentric lamellae cross radial costae, which are ornamented with strongly developed spines or scales. Auricles sculptured with concentric lamellae, more strongly developed on anterior. Hinge line straight.

Right valve covered with regularly spaced, close-set concentric lirae that enlarge near ventral margin to form lamellae. Anterior auricles with 4-7 weak radial riblets covered with concentric lamellae. Posterior auricle with delicate concentric lamellae, very strongly developed on dorsal margin.

Internal lirae 10-15, sometimes one or more rudimentary interstitial lirae, plus 1 or 2 auricular lirae. Lirae commencing in late ontogeny, enlarging into submarginal region. Resilifer triangular. Byssal notch small, no ctenolium.

REMARKS. — The present specimens are similar to the type material from the Sulu Sea, although most have fewer internal lirae. The internal lirae, however, are variable in number, and it is possible that the number in the type specimen (16) is exceptional.

The closest species is *Parvamussium vesiculatum* sp. nov., see below.

Source : MNHN, Paris

Parvamussium thetidis (Hedley, 1902)

Figs 99-102

Amusium thetidis Hedley, 1902: 304, fig. 49.

Synonym:

Ctenamusium salacon Iredale, 1929: 164.

Other references:

Amusium thetidis – Hedley & Petterd, 1906: 223, pl. 38, figs 18-19.
Amussium thetidis – Pritchard & Gatliff, 1904: 266.
Ctenamusium thetidis – Iredale, 1929: 164, 188. — Cotton & Godfrey, 1938: 98, fig. 84. — Cotton, 1961: 102, fig. 88.
Parvamussium thetidis – Dijkstra, 1991: 14. — Lamprell & Whitehead, 1992: no. 35, pl. 6, fig. 35.

Type material. — *A. thetidis*: holotype, rv, AMS C13210, 5 paratypes, v, AMS C171634. — *C. salacon*: holotype, lv, AMS C24345.

Type locality. — *A. thetidis*: 5-8 miles off Port Kembla, New South Wales, Australia, *"Thetis"*, stn 49, 34°28′ S, 151°06-03′ E, 137-115 m. — *C. salacon*: 27 miles E of Sydney Heads, New South Wales, Australia, 549 m.

Material examined. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DW 272, 24°40′ S, 159°43′ E, 500-540 m, 1 spm. – Stn DW 305, 22°09′ S, 159°24′ E, 430-440 m, 1 lv, 1 rv.
Norfolk Ridge. CHALCAL 2: stn DW 73, 24°40′ S, 168°38′ E, 573 m, 2 spms, 5 lv, 4 rv. — Stn DW 74, 24°40′ S, 168°38′ E, 650 m, 2 spms, 4 lv, 5 rv. — Stn DW 75, 24°39′ S, 168°39′ E, 600 m, 2 spms, 2 rv.
Loyalty Islands. MUSORSTOM 6: stn DW 479, 21°09′ S, 167°55′ E, 310 m, 1 lv. — Stn DW 485, 21°23′ S, 167°59′ E, 350 m, 1 lv.
New Hebrides Arc. VOLSMAR: stn DW 30, 22°17′ S, 171°18′ E, 450-550 m, 5 lv, 10 rv.
GEMINI: stn DW 51, 20°59′ S, 170°03′ E, 450 m, 4 lv, 6 rv.

Distribution. — Eastern Australia, Chesterfield Islands as far east as New Hebrides Arc. Present material living at 500-650 m.

Description. – *Shell* rather small, fragile, inequivalve, inequilateral, up to ca. 10 mm high, left valve slightly more convex than right, auricles unequal in size, umbonal angle about 95°. Left valve creamy, sometimes with white spots, opaque; right valve uniform whitish, semi-transparent.

Prodissoconch ca. 210 µm in height.

Left valve sculptured with irregularly spaced radial costae, commencing at ca. 2 mm shell height, enlarging to ventral margin. Concentric lamellae delicate, close-set transversing radial costae. Auricles with delicate, closely-spaced concentric lamellae. Hinge line straight.

Right valve with regularly spaced concentric lirae. Anterior auricle with closely-spaced, concentric lamellae and 1-3 weakly developed radial riblets.

Internal lirae generally 10, with some rudimentary interstitial lirae, plus 1 or sometimes 2 auricular lirae. Lirae fine at first, becoming stronger distally near submarginal region. Hinge line slightly raised at margins, with small scales on dorsal margin. Resilifer triangular. Byssal notch small, no ctenolium.

Remarks. — Closely related species are *Parvamussium cristatellum* (Dautzenberg & Bavay, 1912) from Indonesia and the Bay of Bengal, and *P. siebenrocki* (Sturany, 1901) from the northwestern Indian Ocean. It is possible that both are synonyms, as I have already suggested (Dijkstra, 1991: 14).

P. thetidis is the type species of *Ctenamussium* which Hertlein (1969: N350) synonymized with *Parvamussium*. Indeed, it is a typical *Parvamussium*.

Source : MNHN, Paris

Parvamussium torresi (E.A. Smith, 1885)
Figs 51-54, 125-128

Amussium torresi E.A. Smith, 1885: 311, pl. 23, figs 3-3b.

Other references:

Glyptamusium torresi – IREDALE, 1939: 370.
Propeamussium (Parvamussium) torresi – DIJKSTRA, 1990: 3.

TYPE MATERIAL. — Lectotype (Figs 125-8, H 7.8, L 7.9, D 2 mm) here designated, live taken, BMNH 1887.2.9.3316, 5 paralectotypes BMNH 1887.2.9.3317/1-5. Size of the lectotype is somewhat different from SMITH's measurements, due to some damages near ventral margin of left valve, and marginal apron of right valve broken off.

TYPE LOCALITY. — E of Cape York, Queensland, Australia, *"Challenger"*, stn 185B, 11°38'15" S, 143°59'38" E, 285 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. CHALCAL 1: stn D 13, 19°33' S, 158° 38' E, 390 m, 3 lv.
MUSORSTOM 5: stn DC 291, 23°08' S, 159°28' E, 300 m, 1 rv. — Stn DW 328, 20°23' S, 158°44' E, 340-355 m, 1 spm, 8 lv, 25 rv. — Stn DW 329, 20°23' S, 158°47' E, 320 m, 23 lv, 34 rv. — Stn DW 334, 20°06' S, 158°48' E, 315-320 m, 1 spm, 7 lv, 3 rv. — Stn DW 335, 20°03' S, 158°45' E, 315 m, 1 spm, 3 lv. — Stn DC 376, 19°51' S, 158°30' E, 280 m, 7 lv, 1 rv.
CORAIL 2: stn DC 169, 18°21' S, 155°20' E, 575 m, 1 lv, 2 rv.
New Caledonia. MUSORSTOM 4: stn CC 174, 19°00' S, 163°18' E, 365 m, 2 lv.
Norfolk Ridge. CHALCAL 2: stn DW 71, 24°42' S, 168°09' E, 230 m, 1 lv.
Loyalty Islands. MUSORSTOM 6: stn DW 459, 21°01' S, 167°31' E, 425 m, 22 lv, 58 rv. — Stn DW 468, 21°06' S, 167°33' E, 600 m, 1 lv, 1 rv.
New Hebrides Arc. VOLSMAR: stn DW 17, 22°23' S, 171°41' E, 260-300 m, 1 spm, 1 lv, 1 rv.

DISTRIBUTION. — Torres Strait and Sulu archipelago (SMITH, 1885; DIJKSTRA, 1990). Now also recorded from the Chesterfield Islands, New Caledonia and Loyalty Islands. Present specimens living at 260-355 m.

DESCRIPTION. — *Shell* rather small, fragile, suborbicular, inequivalve, semi-transparent white, up to ca. 9 mm high, left valve somewhat more convex than right, auricles unequal in size, umbonal angle ca. 100°.

Prodissoconch ca. 200 µm in height.

Left valve glossy, very weakly sculptured with irregularly spaced concentric growth lines. Sometimes with minute, close-set concentric lamellae near ventral margin. Auricles smooth: anterior auricle considerable larger than posterior. Hinge line straight.

Right valve covered with regularly spaced concentric lirae, close-set near the umbonal area, becoming more widely spaced towards ventral margin. Anterior auricle sculptured with 1-5 weakly developed radial riblets, absent on posterior. Prominent concentric lamellae near anterior margin, more weakly developed near posterior margin. Hinge line somewhat elevated due to strong lamellation on antero-and postero-dorsal margins.

Internal lirae generally 10, plus 1 small auricular lira on each side. Sometimes with the addition of 1 or 2 rudimentary interstitial lirae. Left valve transparent white, sometimes with white spots, right valve semi-transparent white. Resilifer triangular. Outer ligament well developed. Small byssal notch, no ctenolium.

REMARKS. — The present specimens are very similar to the type material. Small specimens of *P. torresi* and *P. scitulum* are easily confused, because of their variable sculpture. The left valve of *P. torresi* is rather convex, that of *P. scitulum* strongly compressed to nearly flat, and more brightly coloured. The right valve of *P. torresi* is covered with regularly concentric lirae, which are generally lacking on *P. scitulum*.

A closely related species is *Parvamussium formosum* (Melvill & Standen, 1907) from the Gulf of Oman, which is sculptured with weak radial striae near the posterior and anterior margins of the left valve, while the auricles are more strongly sculptured than in *P. torresi*.

Source : MNHN, Paris

P. torresi is the type species of *Glyptamussium*, which was synonymized with *Parvamussium* by HERTLEIN (1969: N350). OYAMA (1944: 242, 244) misspelled the name "*Graptamussium*".

Parvamussium undisonum sp. nov.

Figs 55-58

TYPE MATERIAL. — Holotype MNHN. Paratypes: 5 MNHN, 1 USNM, 2 HD.

TYPE LOCALITY. — Loyalty Islands. MUSORSTOM 6, stn DW 489, 20°48' S, 167°05' E, 700 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn KG 06, 20°34' S, 166°52' E, 735 m, 2 rv (paratypes: MNHN, USNM).
Loyalty Islands. MUSORSTOM 6: stn DW 488, 20°49' S, 167°06' E, 800 m, 4 lv (paratypes: 3 MNHN, 1 HD). — Stn DW 489, 20°48' S, 167°05' E, 700 m, 1 spm (holotype).
New Hebrides Arc. GEMINI: stn DW 55, 20°59' S, 170°01' E, 710 m, 1 spm, 1 rv (paratypes: MNHN, HD).

DISTRIBUTION. — New Caledonia and New Hebrides Arc, 700-800 m, living 700-710 m.

DESCRIPTION. — *Shell* rather small, inequivalve, inequilateral, up to ca. 14 mm high, somewhat higher than wide, left valve slightly more convex than right, translucent white; auricles nearly equal in size, relatively small, umbonal angle ca. 90°.

Prodissoconch ca. 210 µm in height.

Left valve covered with undulating concentric lamellae that cross irregularly spaced radial costae, enlarging towards ventral margin. Auricles with close-set concentric lamellae, which is somewhat more prominent on the anterior auricle. Hinge line straight.

Right valve ornamented with regularly spaced concentric lirae, very weak near submarginal and marginal areas, which are covered by a layer of delicate undulating concentric lamellae (often worn off in dead specimens). Anterior auricle well developed, sculptured with 5 radial riblets, covered with concentric lamellae, which is strongly developed on antero-dorsal margin. Posterior auricle covered with concentric lamellae, which are more prominent on postero-dorsal margin. Marginal apron broken off in all specimens seen.

Internal lirae 10, 4 of them rudimentary, plus 1 small posterior auricular lira on the left valve; 9 lirae plus 2 rudimentary, and 1 posterior auricular lira on right valve. Lirae commencing near adductor insertion scar and enlarging towards to submarginal area. Exterior sculpture of left valve slightly visible from the interior. Outer ligament small. Resilifer triangular. Byssal notch small. Fasciolar pseudo-ctenolium present, with one active tooth.

Dimensions of the holotype: H 14.2, L 13.9, D 3.1 mm.

REMARKS. — The most closely related species is *P. sayanum* (Dall, 1886) from the Gulf of Mexico and West Indies, which has almost identical sculpture. It differs, however, in having more prominent, radial and more widely spaced concentric lamellae, which are more delicate on the auricles.

WALLER (1984: 213) discussed the pseudo-ctenolium in *P. sayanum*, which is an unusual feature in Propeamussiidae. *P. undisonum* is another propeamussiid with an active tooth, only visible in adult specimens. One immature right valve (9 mm high) from BIOCAL stn KG 06 lacks this tooth.

No other propeamussiid species known from the Indo-Pacific region approaches *P. undisonum*.

ETYMOLOGY. — From the undulating sculpture (Latin *undisonus*, adj. = surrounded by wave).

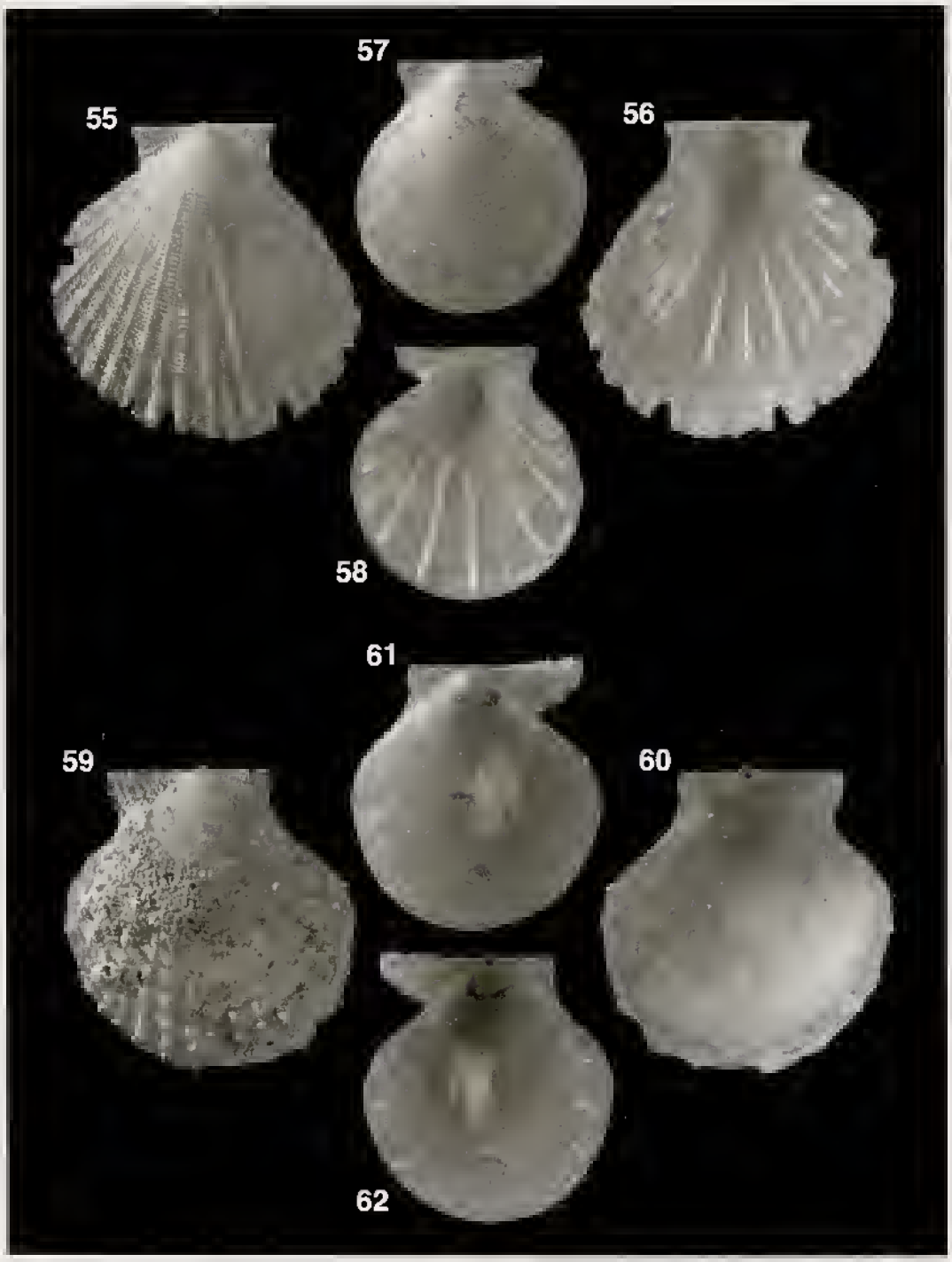
Parvamussium vesiculatum sp. nov.

Figs 59-62, 93-96

TYPE MATERIAL. — Holotype MNHN. Paratypes: 2 AMS C201715, 12 HD, 43 MNHN, 2 NMNZ M268538, 2 NSMT, 2 USNM.

TYPE LOCALITY. — South-east New Caledonia, BIOCAL, stn DW 44, 22°47' S, 167°14' E, 440-450 m.

Source : MNHN, Paris



FIGS 55-62. — **55-58**, *Parvamussium undisonum*, holotype, 14.2 x 13.9 mm (db). — **55**, left valve, exterior. — **56**, left valve, interior. — **57**, right valve, exterior. — **58**, right valve, interior. — **59-62**, *P. vesiculatum*, holotype, 6.0 x 5.8 mm (db). — **59**, left valve, exterior. — **60**, left valve, interior. — **61**, right valve, exterior. — **62**, right valve, interior.

Source : MNHN, Paris

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 15, 22°49' S, 167°12' E, 390-395 m, 1 lv.
BIOCAL: stn DW 08, 20°34' S, 166°54' E, 435 m, 1 rv. — Stn DW 44, 22°47' S, 167°14' E, 440-450 m, 37 spms, 13 lv, 14 rv (holotype and paratypes). — Stn CP 45, 22°47' S, 167°15' E, 430-465 m, 1 lv. — Stn DW 46, 22°53' S, 167°17' E, 570-610 m, 1 rv. — Stn DW 49, 23°03' S, 167°32' E, 825-830 m, 1 rv. — Stn DW 51, 23°05' S, 167°45' E, 680-700 m, 2 lv. — Stn DW 106, 21°36' S, 166°29' E, 625-650 m, 2 spms.
MUSORSTOM 4: stn DW 184, 19°04' S, 163°27' E, 260 m, 1 spm. — Stn DW 210, 22°44' S, 167°09' E, 340-345 m, 1 spm, 2 lv, 1 rv. — Stn DW 222, 22°58' S, 167°33' E, 410-440 m, 2 lv. — Stn DW 234, 22°15' S, 167°08' E, 350-365 m, 1 spm.
Norfolk Ridge. CHALCAL 2: stn DW 76, 23°41' S, 167°45' E, 470 m, 2 spms.
SMIB 3: stn DW 22, 23°03' S, 167°19' E, 503 m, 7 lv.
Loyalty Islands. MUSORSTOM 6: stn DW 479, 21°09' S, 167°55' E, 310 m, 1 lv.

DISTRIBUTION. — New Caledonia and Loyalty Islands, shells in 260-830 m, living in 260-650 m.

DESCRIPTION. — *Shell* small, suborbicular, inequivalve, inequilateral, semi-transparent, up to 6 mm high, left valve slightly more convex than right, auricles unequal in size, umbonal angle ca. 95°.

Prodissoconch ca. 200 µm in height.

Left valve widely spaced concentric lirae with strongly developed nodules or hollow scales, broken off in all specimens seen below umbonal region, commencing almost immediately, close-set at first, becoming stronger and more widely spaced towards ventral margin. Irregular radial riblets between concentric lirae. Auricles covered with concentric lamellae, stronger on anterior auricle, slightly closer on posterior auricle. Hinge line straight.

Right valve with regularly spaced concentric lirae, very weakly developed near umbonal region. Prodissoconch and dissoconch pellucid. Anterior auricle with 4 delicate radial riblets, which are covered by concentric lamellae that develope into scales on the dorsal margin. Posterior auricle with concentric lamellae, strongly developed on dorsal margin. Byssal fasciole well developed.

Internal lirae rudimentary, 5 near anterior and 4 near posterior margin, 1 delicate auricular lira on anterior and a stronger one on posterior of left valve; right valve with 3 rudimentary lirae on anterior, posterior margin with 1 auricular lira on posterior auricle. External sculpture visible from interior of both valves. Resilifer triangular. Byssal notch small, no ctenolium.

Both valves semi-transparent white; right valve with a large white spot at centre of disc.

Dimensions of the holotype: H 6, L 5.8, D 1.8 mm.

REMARKS — A few paratypes lack external sculpture on the left valve (Figs 95-96) after the shell attains 2 mm high, and are very fragile, smooth, glossy and transparent.

Parvamussium vesiculatum most closely resembles *P. texturatum* which is sympatric and is slightly more orbicular with somewhat larger auricles. The radial costae on the left valve are more prominent in the latter species, whereas concentric lirae are more strongly developed and more widely spaced in *P. vesiculatum*. *P. vesiculatum* is ornamented with nodules on the concentric lirae, whereas *P. texturatum* bears more scales. There are also differences in the internal lirae, which are rudimentary and fewer in number in *P. vesiculatum*, and well developed in *P. texturatum*.

ETYMOLOGY. — From the nodular sculpture of the left valve (Latin *vesiculatus*, adj. = with nodules).

Genus *CYCLOCHLAMYS* Finlay, 1926

Cyclochlamys Finlay, 1926: 452. Type species (OD): *Pecten transenna* (*sic*) Suter, 1913. Recent, near the Snares, New Zealand, 91 m.

Synonym:

Chlamydella Iredale, 1929: 164, 188. Type species (OD): *Cyclopecten favus* Hedley, 1902. Recent, off New South Wales, Australia, 75-91 m.

DIAGNOSIS. — *Shell* inequivalve, minute, orbicular to strongly oblique; *left valve* sculptured with radial and/or concentric riblets or striae, *right valve* with commarginally elongate hexagonal

Source : MNHN, Paris

(honeycomb-like) microstructure (simple calcitic prismatic outer layer); auricles unequal; byssal notch well-developed; no ctenolium; no internal lirae.

DISTRIBUTION. — Recent. Subantarctic, South Australia and West Pacific from New Zealand to Japan (HAYAMI & KASE, 1993).

REMARKS. — *Cyclochlamys* was erroneously mentioned as a "*nom. null.*" by HERTLEIN (1969: N353). It differs from *Cyclopecten* by a pteriform shell, a triangular prodissoconch and the commarginally elongate hexagonal (honey-comb like) microstructure of the right valve.

Cyclochlamys favus (Hedley, 1902) comb. nov.

Figs 87-90

Cyclopecten favus Hedley, 1902: 305, fig. 50 (as *C. flavus, sic*).

Synonyms:

Cyclopecten obliquus Hedley, 1902: 306, fig. 51.
Cyclopecten nepeanensis Pritchard & Gatliff, 1904: 338, pl. 20, fig. 5.

Other references:

Chlamydella favus – COTTON & GODFREY, 1938: 98, fig. 85 (after HEDLEY). — COTTON, 1961: 103, fig. 89.

TYPE MATERIAL. — *C. favus*: holotype (H 3.0, L 3.4, D 0.5 mm) live taken, AMS C13231, 20+ paratypes v, AMS C171633. — *C. obliquus*: holotype lv, AMS C13234, 70+ paratypes v, AMS C13232, C13233. — *C. nepeanensis*: holotype lv, NMV F558.

TYPE LOCALITY. — *C. favus*: 5.5-7.5 miles NE of Cape Three Points, New South Wales, Australia, "*Thetis*", stn 13, 33°28′ S, 151°33′ E, 75-91 m. — *C. obliquus*: 5-8 miles off Port Kembla, New South Wales, "*Thetis*", stn 49, 34°28′ S, 151°06-03′ E, 115-137 m. — *C. nepeanensis*: Back Beach, Point Nepean, Victoria, Australia.

MATERIAL EXAMINED. — The type material.
Australia. Off Moreton Bay, Queensland, 27°31' S, 153°40′ E, 75-80 m,1 rv (AMS). — E of Sydney, New South Wales, "*Gascoyne*", stn G2-56-62, 150 m, several valves (AMS). — NE of Woolongong, New South Wales, "*Kapala*", stn K75-05-06, 34°18-24' S, 151°26-21′ E, 466-494 m, 13 v (AMS). — 2.5 miles NE Beaching Bay, Maria Island, SE Tasmania, "*Penghana*", 42°27.5' S, 148°12′ E, 82.5 m, several spms (AMS). — Between Eucla and Esperance, Western Australia, "*Gascoyne*", stn G2-96-62, 79-147 m, several v (AMS).
New Caledonia. BIOCAL: stn DW 44. 22°47′ S, 167°14′ E, 440-450 m, 1 spm (typical). — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 6 spms (typical), 2 spms (var. *obliqua*).

DISTRIBUTION. — Southern Australia and New Caledonia. Present material living at 440-610 m.

DESCRIPTION. — *Shell* small, up to ca. 3 mm high, translucent. Valves dissimilar in shape, size and sculpture.
Prodissoconch ca. 240 µm in height (Figs 87-88).
Left valve somewhat larger, more convex, transparent, smooth except for a few minute concentric growth lines (typical) or with a few more prominent concentric lirae (var. *obliqua*); auricles nearly equal, with some concentric lines. Outer ligament insertion with small holes near resilifer (Fig. 89).
Right valve somewhat smaller, transparent, smooth, with hexagonal microsculpture (Fig. 90). Anterior auricle with close-set concentric lamellae. Byssal notch well developed; no ctenolium.

REMARKS. — The present material is similar in all respects to the type specimen from off New South Wales. *Cyclochlamys favus* is rather variable in sculpture on the left valves with weak or

Source : MNHN, Paris

pronounced concentric growth lines, and sometimes secondary radial striae. Completely smooth specimens are also known.

Genus *Cyclopecten* Verrill, 1897

Cyclopecten Verrill, 1897: 70. Type species (SD, Sykes, Smith & Crick, 1898): *Pecten pustulosus* Verrill, 1873: 14; Recent, off Newfoundland, Canada, 274 m.

Synonym:

Xenamussium Oyama, 1944: 244. [Proposed as a subgenus of *Propeamussium*]. Type species (OD): *Pecten hoskynsi* Forbes, 1844; Recent, "Asia minor" [= off Turkey].

Diagnosis. — *Shell* equivalve, small, usually orbicular, laterally compressed, prodissoconch flat curved; *left valve* usually sculptured with radial and/or concentric costae or striae, *right valve* with concentric lamellae; auricles unequal; byssal notch well-developed; no ctenolium; no internal lirae.

Distribution. — Miocene to Recent. Worlwide, subtidal to hadal (Hayami & Kase, 1993: 59). In the Indo-Pacific *Cyclopecten*, however, only lives in deep-water (Dijkstra, unpubl. data).

Remarks. — In the original diagnosis of *Cyclopecten*, the characters "few pectinidial teeth [= ctenolium], byssus small and a few threads", refer to *"Cyclopecten" orbicularis* (Sowerby) [= *Lissochlamis exotica* (Dillwyn, 1817)], a pectinid species. These characters are not present in *Cyclopecten*, as defined by the type species. There are many described species of *Cyclopecten* but they are currently placed in different genera, for example *Delectopecten* (a pectinid) (Hertlein, 1969; Knudsen, 1970; Habe, 1977; Bernard, 1978; Rombouts, 1991) or *Palliolum* Monterosato, 1884 (also a pectinid) (Abbott, 1974, *pro parte*). Also, several *"Cyclopecten"* species described from the subantaretic region, belong to *Cyclochlamys* (Dijkstra, unpubl. data). *Cyclopecten* is morphologically closest to *Parvamussium*. As Hayami & Kase (1993: 59) suggested, *Cyclopecten* may have been derived from *Parvamussium* through paedomorphic evolution. Shell characters of *Xenamussium* are sufficiently similar to *Cyclopecten* to suggest synonymy.

Cyclopecten horridus sp. nov.

Figs 63-64, 98

Type material. — Holotype mnhn. Paratypes: 5 mnhn, 2 hd.

Type locality. — Loyalty Islands, musorstom 6, stn DW 420, 20°29′ S, 166°43′ E, 600 m.

Material examined. — **New Caledonia**. biocal: stn KG 06, 20°34′ S, 166°52′ E, 735 m, 1 lv (paratype). — Stn DW 08, 20°34′ S, 166° 53′ E, 435 m, 3 lv, 2 rv (paratypes: 3 mnhn, 2 hd). biogeocal: stn DW 307, 20°35′ S, 166°55′ E, 470-480 m, 1 lv (paratype).
Loyalty Islands. musorstom 6: stn DW 420, 20°29′ S, 166°43′ E, 600 m, 1 spm (holotype).

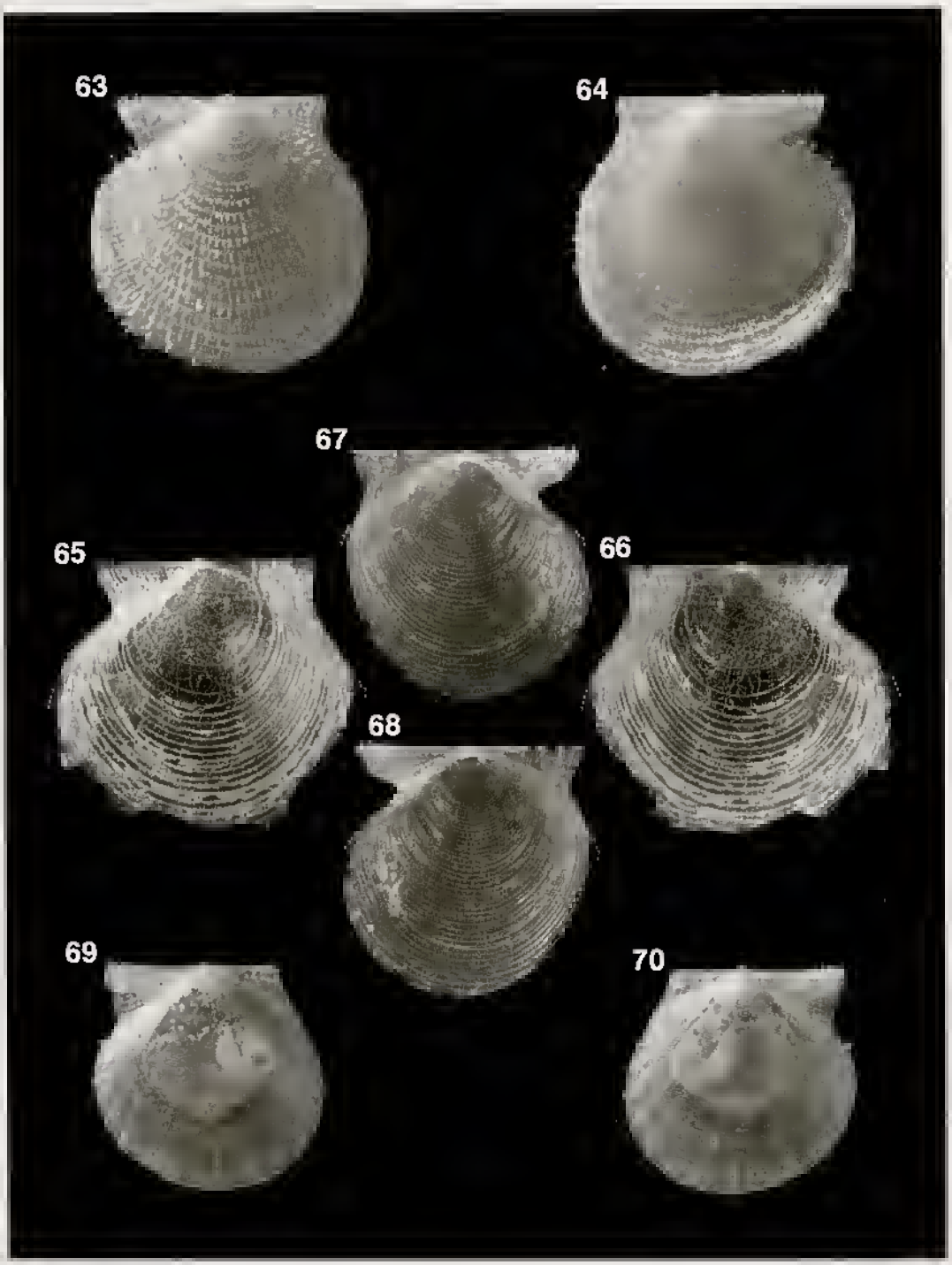
Distribution. — New Caledonia and Loyalty Islands, shells in 435-735 m, living in 600 m.

Description. — *Shell* small, suborbicular, inequivalve, up to ca. 6 mm high, left valve more convex than right, marginal apron of right valve pressed against margin of interior of left valve, auricles of nearly equal size, umbonal angle ca. 125°, whitish opaque.

Prodissoconch ca. 220 µm in height.

Left valve covered with regular concentric lamellae, closely-set in early ontogeny, enlarging towards periphery. Erect hollow spines developing on lamellae (Fig. 98), which are stronger near the ventral margin (broken off near umbonal area in all specimens seen). Crowded microscopic granules between concentric lamellae, radial scratches added in late ontogeny. Auricles covered with sculpture identical to that on exterior of disc.

Source : MNHN, Paris



FIGS 63-70. — **63-64**, *Cyclopecten horridus*, holotype, 5.9 x 6.0 mm (db). — **63**, left valve, exterior. — **64**, right valve, exterior. — **65-68**, *C. pellucidulus*, holotype, 6.1 x 6.8 mm (db). — **65**, left valve, exterior. — **66**, left valve, interior. — **67**, right valve, exterior. — **68**, right valve, interior. — **69-70**, *Delectopecten musorstomi*, BIOCAL: stn DW 64, 4.3 x 4.3 mm (db). — **69**, left valve, exterior. — **70**, right valve, exterior.

Source : MNHN, Paris

Right valve with regular concentric lirae, close-set to 2 mm shell height, then transformed into more widely spaced, undulating concentric lamellae with delicate spines near ventral margin. Granulate microsculpture between the concentric lirae and lamellae. Anterior auricle sculptured with 3 radial riblets covered with concentric lamellae. Posterior auricle poorly differentiated from disc, covered with concentric lirae. Hinge line straight. Antero-dorsal margin with scales, squamae weakly developed on postero-dorsal margin. Byssal notch strongly developed. No ctenolium.

Dimensions of the holotype: H 5.9, L 6, D 1.6 mm.

REMARKS. — A somewhat similar species is *Parvamussium araneum* Dijkstra, 1991 from the Indonesian Archipelago. This species has a few internal rudimentary lirae, and micro-sculpture on the right valve has radial scratches. Another related species is *P. vidaleuse* (Barnard, 1964) from off Zululand, South Africa. The radial sculpture of *P. vidalense* is somewhat weaker than in *P. araneum*, with overriding concentric lamellae, while the erect spines are weaker. Moreover, a few more internal rudimentary lirae are present in *P. vidalense* than in *P. araneum*, but they are absent in *C. horridus*.

Some shell features of *C. horridus* resemble those characteristic of *Delectopecten*, such as arrangement of erect spines on concentric lamellae, and strongly developed byssal notch. A ctenolium however, is absent, and the sculpture of the right valve is more similar to that in *Cyclopecten*.

ETYMOLOGY. — From the spiny sculpture (Latin *horridus*, adj. = bristly).

Cyclopecten pellucidulus sp. nov.

Figs 65-68

TYPE MATERIAL. — Holotype MNHN. Paratypes: 1 HD, 2 MNHN.

TYPE LOCALITY. — South of New Caledonia, BIOCAL, stn DW 51, 23°05' S, 167°44' E, 680-700 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality, northern Norfolk Ridge, alive in 680-700 m.

DESCRIPTION. — *Shell* small, fragile, pellucid, suborbicular, inequivalve, up to ca. 6 mm high, left valve slightly more convex than right, auricles equal in size, umbonal angle ca. 125°.

Prodissoconch ca. 230 µm in height.

Left valve covered with curved concentric lamellae, commencing at 2 mm shell height, enlarging towards ventral margin. Umbonal area smooth and glossy. Auricles with close-set concentric lamellae.

Right valve covered with delicate regularly spaced concentric lirae that gradually enlarge, interspaces with microscopic radial scratches. Anterior auricle with concentric lamellae, stronger than on posterior auricle, strongly developed scales on antero-dorsal margin. Exterior sculpture visible from interior of both valves. Interior with one weak liration on the inner side of each auricle. Resilifer triangularly elongate. Byssal notch present, no ctenolium. Outer ligament small.

Dimensions of the holotype: H 6.1, H 6.8, D 1.2 mm.

REMARKS. — A somewhat similar species is *Cyclopecten aupouria* Powell, 1937 from northern New Zealand, which attains larger size, is more convex, and is opaque white with more delicate concentric lirae and finer radial lirae. Another related species is *C. bavayi* Dijkstra, 1990 from the Ceram Sea (Indonesia), which is also slightly larger, opaque, and covered with numerous concentric lamellae on the early disc, and small radial riblets, which are absent in *C. pellucidulus*.

ETYMOLOGY. — From the translucence of the shell (Latin *pellucidulus*, adj. = translucent).

Source : MNHN, Paris

Family ENTOLIIDAE Teppner, 1922

Entoliidae Teppner, 1922: 89, 274.

Synonym:
Syncyclonemidae Waller, 1978: 353.

DIAGNOSIS. — Byssate or free Pectinoidea, lacking prismatic calcite; foliated calcite thin or absent; crossed-lamellar aragonite dominant extending to margins; byssal notch without ctenolium.

REMARKS. — WALLER (1978) described a new family Syncyclonemidae in Pectinoidea, and treated *Pectinella* as a junior synonym of *Syncyclonema* Meek, 1864. Later, he reduced Syncyclonemidae in rank within the family Entoliidae, and reinstated *Pectinella* as a Recent genus (WALLER, 1984: 219).

Genus *PECTINELLA* Verrill, 1897

Pectinella Verrill, 1897: 68. Type species (OD): *Pecten (Pseudamusium) sigsbeei* Dall, 1886; Recent, Cuba, 289 m.

DIAGNOSIS. — *Shell* equivalve, small, transparent, nearly smooth, with convex and nearly equal valves: auricles very unequal, oblique; byssal notch well-developed; no ctenolium.

DISTRIBUTION. — Recent, Gulf of Mexico, Caribbean Sea, central and western Pacific; 240-300 m.

Pectinella aequoris Dijkstra, 1991

Figs 71-74

Pectinella aequoris Dijkstra, 1991: 23, figs 78-86.

TYPE MATERIAL. — Holotype lv, RMNH 56567, 4 paratypes rv, RMNH 56568-56569.

TYPE LOCALITY. — Indonesia, Bay of Sanggar, N of Sumbawa, *"Snellius-II"*, stn 4.111, 8°19.3′ S, 118°15.6′ E, 175-185 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DW 272, 24°41′ S, 159°43′ E, 500-540 m, 1 lv.
Loyalty Islands. BIOGEOCAL: stn DW 296, 20°38′ S, 167°10′ E, 1230-1270 m, 1 lv.
MUSORSTOM 6: stn DW 397, 20°47′ S, 167°05′ E, 380 m, 1 lv. — Stn DW 474, 21°09′ S, 167°55′ E, 260 m, 1 spm.
VOLSMAR: stn DW 38, 22°22′ S, 168°44′ E, 380-420 m, 1 lv.

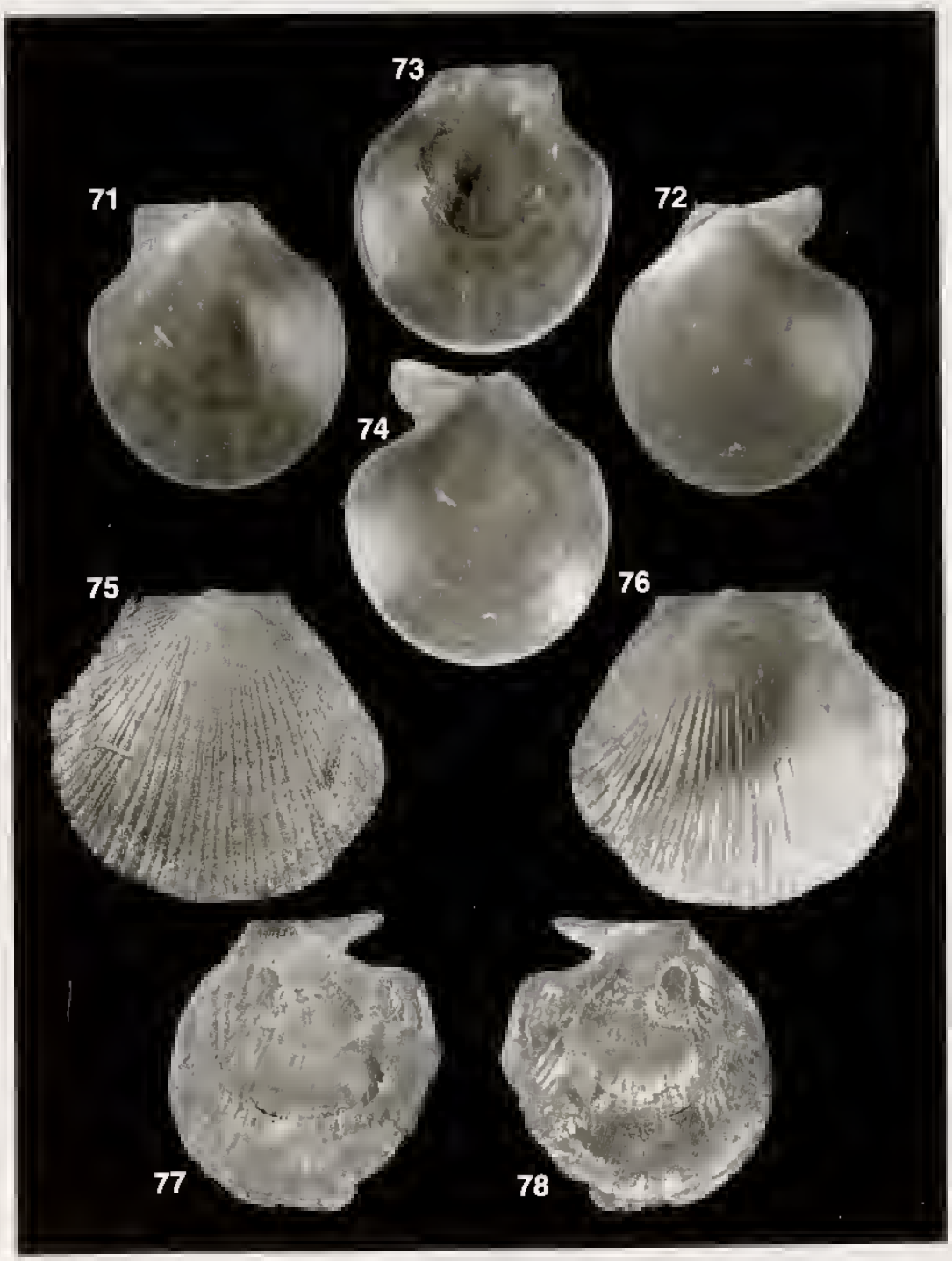
DISTRIBUTION. — Indonesia, Hawaiian Islands and Fiji Islands (DIJKSTRA, 1991). Now also found in the Chesterfield Islands and the Loyalty Islands. Present material living at 260 m.

DESCRIPTION. — *Shell* rather small, convex, elongate, slightly equivalve, semi-transparent, up to ca. 20 mm high, right valve somewhat more convex than left, auricles unequal in size, umbonal angle ca. 90°.

Prodissoconch ca. 220 µm in height.

Left valve smooth, glossy, with microscopic radially diverging scratches. Delicate close-set concentric striae enlarging towards ventral margin. A few concentric lirae near umbonal region. Some specimens with a few delicate, irregularly spaced radial grooves that commence near centre of disc and enlarge ventral margin (visible from interior as very weak lirae).Anterior auricle with concentric lirae, weaker on posterior. Delicate concentric striae near lateral margin. Hinge line straight. Internal surface glossy, and microscopically

Source : MNHN, Paris



FIGS 71-78. — **71-74**, *Pectinella aequoris*, MUSORSTOM 6: stn DW 474, 18.2 x 16.6 mm (db). — **71**, left valve, exterior. — **72**, left valve, interior. — **73**, right valve, exterior. — **74**, right valve, interior. — **75-78**, *Pseudohinnites levii*, BIOGEOCAL: stn CP 273, paratypes, 41.8 x 45.1 mm (lv), 28.9 x 37.2 mm (rv). — **75**, left valve, exterior. — **76**, left valve, interior. — **77**, right valve, exterior. — **78**, right valve, interior.

Source MNHN, Paris

granulated. One liral tooth (auricular crura) formed near border of each auricle. Resilifer triangularly elongate. Cardinal crura rather broad near resilial pit on antero-dorsal region. A prominent tooth near pit on postero-dorsal region.

Right valve with similar microsculpture to that of left valve. Auricles strongly produced on dorsal margin. Antero-dorsal region of auricles with narrow straight groove, hinge line strongly raised. Postero-dorsal side of auricles a small depression. Byssal notch well developed, no ctenolium.

Creamy transparent with orange-brown and white maculations on left valve, right valve transparent and uniformly cream.

REMARKS. — The present specimens are similar to the type material, although larger in size. For comparison with *Pectinella sigsbeei* and other species, see DIJKSTRA (1991: 25).

Family PECTINIDAE Wilkes, 1810

Pectinidae [as Pectinoidae] Wilkes, 1810: 32 [emend. Waller, 1978]

DIAGNOSIS. — Byssate, cemented, or free living Pectinoidea with outer, prismatic calcited layer on right valve; crossed-lamellar aragonite inside of pallial line or absent; byssal notch with ctenolium, at least at early growth stages.

REMARKS. — The family Pectinidae is usually attributed to RAFINESQUE (1815). WILKES, however, has priority. For synonymy see HERTLEIN (1969: N348).

Genus *PSEUDOHINNITES* Dijkstra, 1989

Pseudohinnites Dijkstra, 1989: 29. Type species (OD): *Pseudohinnites levii* Dijkstra, 1989.

DIAGNOSIS. — *Shell* inequivalve, medium-sized, fragile, very irregular, with a *Hinnites*-like appearance; auricles unequal; *left valve* convex, right valve flat; exterior of left valve with irregular radial costae and concentric lamellae overlying the radial costae and interstices; *right valve* smooth, with irregular concentric waves or irregular depressions, giving a deformed appearance; byssal notch with ctenolium.

DISTRIBUTION. — Recent. Western to southwestern Pacific; 700-2000 m.

REMARKS. — *Pseudohinnites* somewhat resembles *Hyalopecten*, although the former has different shape ("*Hinnites*-like"), whereas the latter is regular undulated. *Pseudohinnites* is still under study and will be discussed elsewhere (KNUDSEN & DIJKSTRA, in prep.).

Pseudohinnites levii Dijkstra, 1989

Figs 75-78

Pseudohinnites levii Dijkstra, 1989: 29, figs 1-3; 1990: 7, figs 14-15.

TYPE MATERIAL. — Holotype and paratypes MNHN.

TYPE LOCALITY. — SE of New Caledonia, BIOCAL, stn DW 70, 23°25′ S, 167°53′ E, 965 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 2 fragm. lv, 3 fragm. rv (paratypes). — Stn CP 30, 23°09′ S, 166°41′ E, 1140 m, 4 fragm. lv, 1 fragm. rv (paratypes). — Stn DW 70, 23°25′ S, 167°53′ E, 965 m, 1 lv (holotype). — Stn DW 80, 20°32′ S, 166°48′ E, 900-980 m, 1 rv (paratype).

Source : MNHN, Paris

BIOGEOCAL: stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 1 lv. — Stn CP 243, 21°27′ S, 166°26′ E, 1820 m, 3 lv. — Stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 3 lv, 2 rv (paratypes). — Stn CP 265, 21°04′ S, 167°00′ E, 1760-1870 m, 1 fragm. lv. — Stn CP 273, 21°02′ S, 166°57′ E, 1920-2040 m, 4 lv, 3 rv (paratypes).
CALSUB: dive 13, 21°26′ S, 166°23′ E, 1567-1807 m, 1 spm (juv.).
Loyalty Islands. MUSORSTOM 6: stn CP 438, 20°23′ S, 166°20′ E, 780 m, 2 rv. — Stn DW 488, 20°49′ S, 167°06′ E, 800 m, 2 lv, 2 rv. — Stn DW 489, 20°48′ S, 167°06′ E, 700 m, 2 fragm. rv.
New Hebrides Arc. SUBPSO: dive 7, sample 706, 15°50′ S, 166°42′ E, 2000 m, 2 spms.

DISTRIBUTION. — DIJKSTRA (1989) described this species from New Caledonia, and recorded material from the Philippines and Indonesia (DIJKSTRA 1989, 1990). Now also found from the Loyalty Islands and the New Hebrides Arc. Present specimens living at 1567-2000 m.

DESCRIPTION. — *Shell* medium-sized, fragile, semi-transparent white, interior nacreous, suborbicular, inequivalve, variable in shape, left valve strongly convex, right valve flat to slightly concave, up to ca. 35 mm high, auricles unequal, umbonal angle ca. 110°.

Prodissoconch ca. 300 µm in height.

Left valve covered with rather regular, closely spaced, radial costae, which multiply and enlarge towards ventral margin. Irregular close-set concentric lamellae between and across radial costae, commencing at ca. 10 mm shell height and enlarging to form slightly scaly lamellae near periphery. Auricles continuous with disc margins, sculpture similar to that on disc. Hinge line straight.

Right valve irregularly indented, ornamented with delicate, rather regularly spaced, undulating radial lirae. Anterior auricle separated from disc by a distinct suture, posterior continuous with disc margin, auricular sculpture similar to that on disc. Byssal notch present. Inactive and active ctenolium (4-7 teeth). Hinge line somewhat elevated. Two indistinct resilial teeth are present; no dorsal teeth (crura). Resilifer triangular, outer ligament very small.

REMARKS. — The present specimens of *P. levii* will make it possible to supplement the original description with information on the anatomy (KNUDSEN & DIJKSTRA, in prep.). For comparison with *Pseudohinnites adamsi* (Dall, 1886) from the West Indies, see DIJKSTRA (1989: 32).

Genus *HYALOPECTEN* Verrill, 1897

Hyalopecten Verrill, 1897: 63, 71, pl. 18, fig. 5. Type species (OD): *Pecten undatus* Verrill & S. Smith *in* Verrill, 1885; Recent, off Chesapeake Bay, Maryland, USA, 2603 m.

REMARKS. — *P. undatus* Verrill & S. Smith is a homonym of *Pecten undatus* Defrance, 1825 and a senior synonym of *Hyalopecten dilectus* Verrill & Bush *in* Verrill, 1897 [Recent, off Martha's Vineyard, Massachusetts, USA, 3316 m], which then becomes the valid name of the type species (see NORTH, 1951a: 234).

DIAGNOSIS. — *Shell* inequivalve, compressed, hyaline; valves with concentric undulations or corrugations and sculptured with fine radial lirae on one or both valves; auricles unequal; byssal notch well-developed, ctenolium present.

DISTRIBUTION. — Miocene to Recent, worldwide, 800-7000 m (KNUDSEN, 1970).

REMARKS. — GRAU (1959: 55) treated *Hyalopecten* as a subgenus of *Cyclopecten* (a propeamussiid), and was followed by KNUDSEN (1970: 97) and ROMBOUTS (1991: 79). HERTLEIN (1969: N354) considered *Hyalopecten* a subgenus of *Palliolum* (a pectinid), placed in the *Eburneopecten* group, and VAUGHT (1989: 119) placed *Hyalopecten* in the tribe Eburneopectinini. *Hyalopecten* is considered a valid Recent genus of Pectinidae by other authors (BERNARD, 1983; SCHEIN, 1988, 1989; DELL, 1990; DIJKSTRA, 1991). WALLER & MARINCOVICH (1992: 219) consider *Hyalopecten* as related to a radially sculptured ancestor, *Praechlamys* Allasinaz, 1972 from the Triassic, without placing it in a higher taxon.

Source : MNHN, Paris

Hyalopecten mireilleae sp. nov.

Figs 79-82

TYPE MATERIAL. — Holotype MNHN. Paratypes: 2 MNHN, 2 HD.

TYPE LOCALITY. — S New Hebrides Arc, VOLSMAR, stn DW 55, 20°59′ S, 170°02′ E, 710 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn CP 72, 22°09′ S, 167°33′ E, 2100-2110 m, 1 juv. rv (paratype). — Stn KG 85, 20°59′ S, 167°00′ E, 1639 m, 1 lv (paratype).
Loyalty Islands. MUSORSTOM 6: stn CP 438, 20°23′ S, 166°20′ E, 780 m, 1 lv (paratype HD). — Stn DW 489, 20°48′ S, 167°06′ E, 700 m, 1 rv (paratype HD).
New Hebrides Arc. GEMINI: stn DW 55, 20°59′ S, 170°02′ E, 710 m, 1 spm (holotype).

DISTRIBUTION. — Eastern New Caledonia to the New Hebrides Arc, 700-2110 m, living in 710 m.

DESCRIPTION. — *Shell* small, up to ca. 14 mm high, fragile, oblique, elongate, inequivalve, inequilateral, semi-transparent white, right valve more convex than left, auricles unequal, umbonal angle ca. 90°.

Prodissoconch ca. 200 µm in height.

Left valve externally sculptured over entire surface with regular spaced concentric lamellae that enlarge towards ventral margin. Lamellae near periphery more strongly curved and more irregularly and closely spaced. Delicate radial lirae between concentric lamellae, more prominent directly beneath each concentric lira. Anterior and posterior auricles with curved, closely spaced concentric lirae, somewhat more prominent and widely arranged on anterior. Anterior auricle larger than posterior auricle, sculpture similar to that of disc margins. External sculpture visible from interior. Interior surface nacreous.

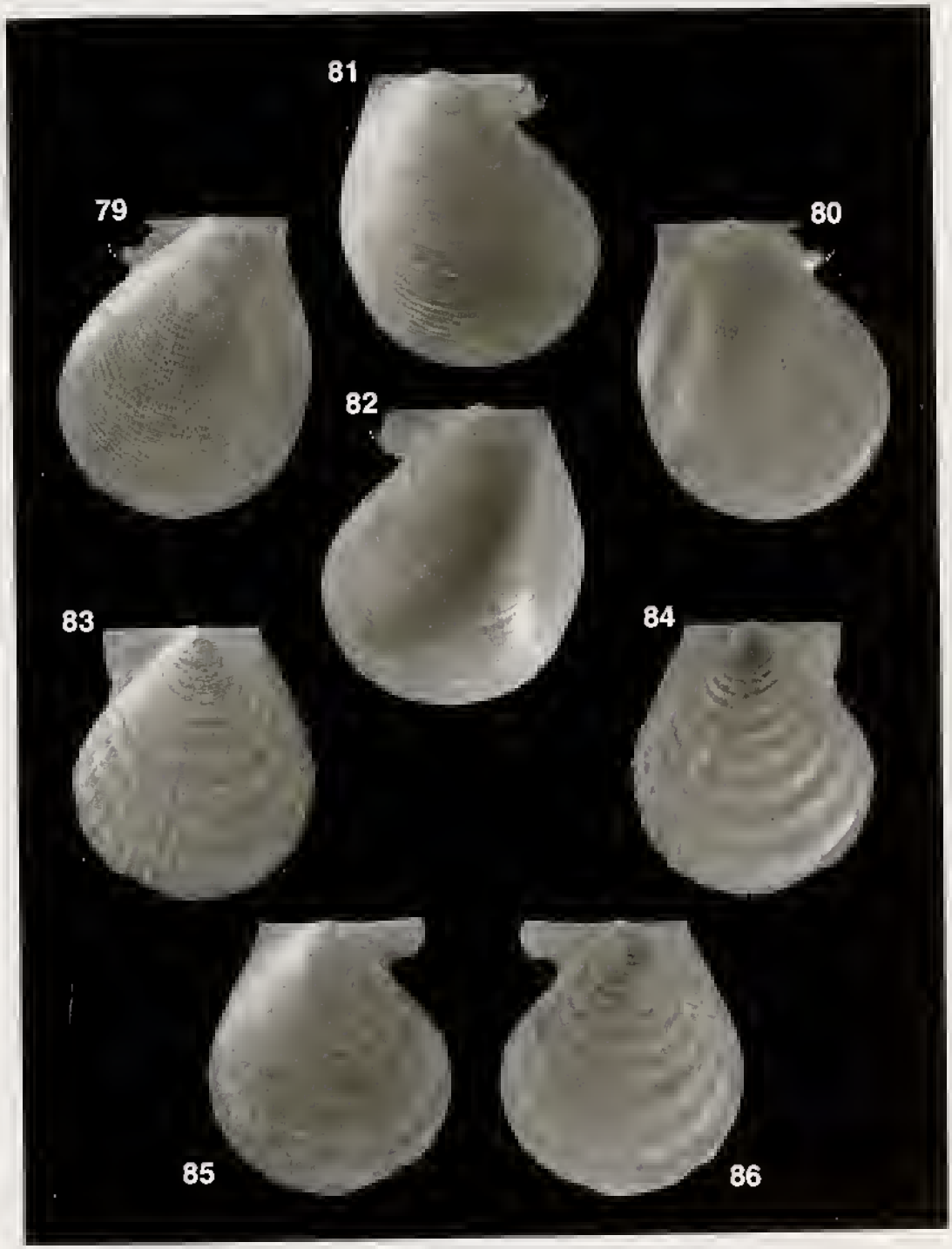
Right valve with regular concentric lamellae and many delicate interstitial radial lirae similar to those on left valve. Anterior auricle separated from disc by distinct suture, sculptured with irregularly spaced, concentric lamellae, developed into spinous scales on dorsal margin. Posterior auricle with close-set concentric lamellae and continuous with the disc margin. Resilifer triangular. No cardinal crura exposed. Only an inactive ctenolium is developed (two teeth of active ctenolium are developed in paratype from BIOCAL: stn CP 72). Byssal notch present.

Dimensions of the holotype: H 13.4, L 11, D 5.6 mm.

REMARKS. — A somewhat similar species is *Hyalopecten tydemani* Dijkstra, 1990 from the Ceram Sea (Indonesia), which is smaller, less oblique, and ornamented with very closely spaced concentric lamellae. Moreover, the delicate interstitial radial lirae are absent. The western Atlantic species *H. strigillatus* (Dall, 1889) is more like *H. tydemani*, but is somewhat more strongly sculptured with closely spaced concentric lamellae. The anterior auricle of the right valve in both species is relative smaller in *H. mireilleae*. *Hyalopecten pudicus* (E.A. Smith, 1885) from the southern Indian Ocean is more depressed, slighly more orbicular, with an undulating surface. *H. pudicus* is more similar to *H. dilectus* from the Atlantic Ocean. *Hyalopecten neoceanicus* (Dall, 1908) from the Galapagos Islands is more orbicular and depressed with a slightly undulating surface, and reticulate sculpture. *Hyalopecten profundicola* (Okutani, 1962) from abyssal depths of Japan is more depressed, more oblique and orbicular, and the right valve has more closely spaced lamellae. *Hyalopecten hadalis* (Knudsen, 1970) from the Kermadec Trench is somewhat larger (up to 20 mm in height), oblong, strongly undulated, and sculptured with fine, close-set radial striae, anterior auricle of the right valve very small and byssal notch well developed. *Hyalopecten* sp. (KNUDSEN, 1970: 102) from the Tasman Sea is much larger (up to ca. 35 mm), also oblong and strongly undulated, and sculptured with radial riblets.

ETYMOLOGY. — Named after Mrs Mireille Moreau, technician at MNHN, who has skilfully been processing the bivalves from the various expeditions around New Caledonia.

Source : MNHN, Paris



FIGS 79-86. — **79-80**, *Hyalopecten mireilleae*, holotype, 13.4 x 11.0 mm (lv). — **79**, left valve, exterior. — **80**, left valve, interior. — **81-82**, MUSORSTOM 6: stn CP 438, paratype, 12.1 x 10.4 mm (rv). — **81**, right valve, exterior. — **82**, right valve, interior. — **83-86**, *Delectopecten fluctuatus*, CALSUB: dive 15, 4.5 x 5.1 mm (db). — **83**, left valve, exterior. — **84**, left valve, interior. — **85**, right valve, exterior. — **86**, right valve, interior.

Source : MNHN, Paris

Subfamily CAMPTONECTINAE Habe, 1977

DIAGNOSIS. — Pectinidae with antimarginal microsculpture, weak radial costae or striae sometimes present; shell microstructure of outer lathic or foliated calcite, inner crossed-lamellar aragonitic layer to margins; auricles unequal; byssal notch with ctenolium.

Genus *DELECTOPECTEN* Stewart, 1930

Delectopecten Stewart, 1930: 118. [Proposed as a subgenus of *Palliolum*]. Type species (OD): *Pecten (Pseudamusium* [*sic*]*) vancouverensis* Whiteaves, 1893; Recent, British Columbia, Canada, 18-37 m.

DIAGNOSIS. — *Shell* inequivalve, small, fragile, nearly orbicular, valves nearly equal convex, sculptured with concentric rows of scales or vesicles, spinose radial ridges and/or fine diverged radial striae; byssal notch well-developed; ctenolium present.

DISTRIBUTION. — Early Cretaceous to Recent, worldwide, 27-4256 m (CLARKE, 1962).

REMARKS. — GRAU (1959: N38) considered *Delectopecten* a subgenus of *Cyclopecten* and synonymized *Arctinula* Thiele, 1934 and *Catillopecten* Iredale, 1939. Characters of *Arctinula*, however, are similar to those of *Similipecten* Winckworth, 1932 (SCHEIN, 1989: 96), now placed in Propeamussiidae. *Catillopecten* is also considered a Recent genus of Propeamussiidae (SCHEIN, 1988, 1989), and most closely related to *Bathypecten* Schein-Fatton, 1985.

HERTLEIN (1969: N354) treated *Delectopecten* as a subgenus of *Palliolum*, placed in the *Eburneopecten* group. Currently, however, *Delectopecten* is interpreted as a Recent genus of Pectinidae (MOORE, 1984: B13; WALLER, 1991: 13; WALLER & MARINCOVICH, 1992: 219) and placed in the subfamily Camptonectinae.

Delectopecten alcocki (E.A. Smith, 1904)

Figs 111-114, 147-150

Pecten alcocki E.A. Smith, 1904: 13.

Other references:

Pecten alcocki – ALCOCK, ANNANDALE & MCGILCHRIST, 1907: pl. 18, figs 4, 4a-b. — KNUDSEN, 1967: 282, pl. 2, figs 3-4, textfig. 19.
Pecten (Pseudamussium) alcocki – THIELE & JAECKEL, 1931: 6.
Propeamussium (Hyalopecten) alcocki – WINCKWORTH, 1940: 26.
Delectopecten alcocki – POUTIERS, 1981: 331, pl. 1, fig. 1. — DIJKSTRA, 1991: 26, fig. 87.

TYPE MATERIAL. — Lectotype live taken, (Figs 147-150; H 19.0, L 18.0, D 7.0 mm), here designated, ZSI M669/1, and 29 paralectotypes ZSI M667-668, M670-698/1.

TYPE LOCALITY. — Off southern India, "*Investigator*", stn 232, 7°17' N, 76°54' E, 786 m.

MATERIAL EXAMINED. — The type material,
Chesterfield Islands. MUSORSTOM 5: stn CP 387, 20°53' S, 160°52' E, 650-660 m, 1 lv, 1 rv.
CORAIL 2: stn DE 14, 21°01' S, 160°57' E, 650-660 m, 1 spm.

DISTRIBUTION. — SMITH (1904) described this species from off southern India. THIELE & JAECKEL (1931), KNUDSEN (1967) and DIJKSTRA (1991) added records from the Philippines, the Banda

Source : MNHN, Paris

Sea and Sumatra (Indonesia), Gulf of Aden and eastern Africa. Now its range is extented to the Chesterfield Islands. Present material living at 650-660 m.

DESCRIPTION. — *Shell* up to ca. 15 mm high, orbicular, semi-transparent white, auricles nearly equal in size, umbonal angle ca. 125°.

Prodissoconch ca. 280 µm (KNUDSEN, 1967).

Left valve with delicate diverging radial striae over entire disc. Crenulated concentric growth lines with radially aligned scales. Auricles identically sculptured and continuous with the disc. Hinge line straight.

Right valve sculptured as on left valve, although somewhat weaker. Anterior auricle separated from disc by a suture, with 2-4 radiating ridges and radial lamellae. Byssal fasciole and notch strongly developed. Inactive and active ctenolium (3-5 teeth) present. Resilifer triangular. External sculpture barely visible from interior.

Anatomy described by KNUDSEN (1967: 282).

REMARKS. — The present material corresponds in all aspects with the type material. Further notes on soft parts and ecology are given by KNUDSEN (1967: 283) and DIJKSTRA (1991: 26).

Delectopecten fluctuatus (Bavay, 1905)

Figs 83-86

Pecten (Chlamys) fluctuatus Bavay, 1905: 188, pl. 17, figs 3a-b.

TYPE MATERIAL. — Holotype, ?live taken, ZSI M 3359/1.

TYPE LOCALITY. — Off Andaman Islands, depth unknown.

MATERIAL EXAMINED. — The type material.
Loyalty Islands. CALSUB: dive 15, 20°37' S, 166°58' E, 538 m, 1 spm (juv.).

DISTRIBUTION. — Andaman Islands and the Loyalty Islands. The present specimen living at 538 m.

DESCRIPTION. — *Shell* up to ca. 10 mm high, fragile, suborbicular, undulating, slightly inequilateral, semi-transparent white to opaque cream, auricles unequal, umbonal angle 90°-105°.

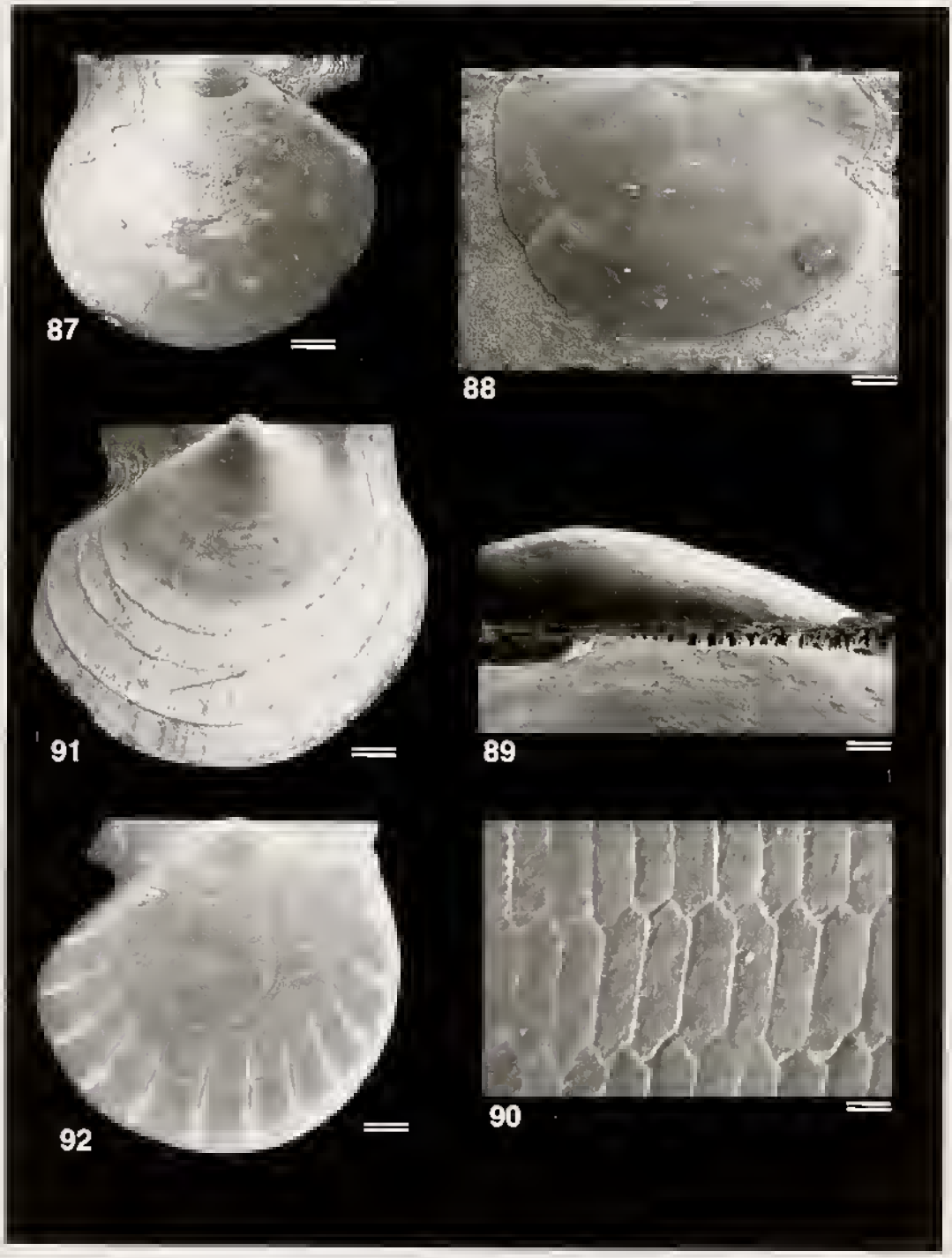
Prodissoconch ca. 200 µm in height.

Left valve undulating and complexly sculptured with fine, regularly spaced, scaly radial riblets, commencing at ca. 2 mm shell height and progressively enlarging and multiplying by intercalation to ca. 30. Delicate, closely spaced lamellae between radial riblets commencing early on disc, enlarging towards ventral margin. Entire surface of disc covered with microscopic diverging striae. Anterior auricle larger than posterior, both auricles sculptured with delicate, close-set, concentric lamellae, and very fine radial striae; posterior auricle more nearly continuous with disc margin. Hinge line straight. A few small scales on dorsal margin. External sculpture sometimes visible from interior of valves.

Right valve undulating, sculptured as in left valve but with smaller scaly radial riblets. Anterior auricle separated from disc by distinct suture, posterior continuous with disc. Anterior auricle with 4 very weak radial riblets, covered with concentric lamellae. Strongly developed scales on anterodorsal margin. Byssal fasciole and notch well developed. Inactive and active ctenolium (3 teeth) present. Resilifer triangular. No cardinal crura.

REMARKS. — The present immature specimen is similar to the type specimen, although semi-transparent white instead of opaque cream as in the holotype. Moreover, the scaly sculpture is somewhat more prominent in the holotype. *Delectopecten alcocki* is closely related but is more orbicular and larger, with an almost smooth exterior surface, and without any undulations. *D. macrocheiricola* (Habe, 1951), from Japan, is more weakly sculpture with diverging scratches, and the surface of its disc is more weakly undulating, especially on the early disc. Habe's species is also much larger (up to 25 mm high). *D. musorstomi* is orbicular with a stronger sculpture, diverging radial scratches and weaker concentric lirae. DIJKSTRA (1989: 32) suggested that *D. fluctuatus* could possibly be a *Pseudohinnites*, but after examining the badly damaged holotype (ZSI), I have come to the conclusion that it is a *Delectopecten*.

Source : MNHN, Paris



FIGS 87-92. — **87-90**, *Cyclochlamys favus*, BIOCAL: stn DW 46. — **87**, right valve, exterior, scale bar 200 µm. — **88**, right valve, dissoconch stage, scale bar 50 µm. — **89**, right valve, hollow sections internal ligament, scale bar 25 µm. — **90**, right valve, hexagonal prismatic microstructure, scale bar 10 µm. — **91-92**, *Parvamussium multiliratum*, BIOCAL: stn CP 75, paratypes. — **91**, left valve, exterior, scale bar 350 µm. — **92**, right valve, interior, scale bar 350 µm.

Source : MNHN, Paris

Delectopecten musorstomi Poutiers, 1981

Figs 69-70

Delectopecten musorstomi Poutiers, 1981: 331, pl. 1, figs 2-3.

Other reference:
Delectopecten musorstomi – Dijkstra, 1991: 26.

Type material. — Holotype live taken, MNHN.

Type locality. — N of Lubang, Philippines, MUSORSTOM 1, stn 18, 13°57' N, 120°17' E, 150-159 m.

Material examined. — The type material.
New Caledonia. BIOCAL: stn DW 64, 24°48' S, 168°09' E, 250 m, 1 spm.

Distribution. — Philippines (Poutiers, 1981), Indonesian Archipelago (Dijkstra, 1991), now extended to New Caledonia. Present material living at 250 m.

Description. — *Shell* small, up to ca. 5 mm high, orbicular, transparent, equivalve, equilateral, anterior auricle somewhat larger than posterior, umbonal angle ca. 120°.

Prodissoconch ca. 200 µm in height.

Left valve covered with microscopic diverging radial striae and 14-20 fine, irregularly spaced, scaly radial lirae, that commence at ca. 1 mm shell height and progressively enlarge. Fine regularly spaced, somewhat crenulated, concentric growth lines. Scales often broken. Auricles continuous with the disc and similarly sculptured. Hinge line straight.

Right valve sculptured similar to that of left valve, with slightly stronger microscopic concentric lirae in early disc, that commence at about 1.5 mm shell height. Anterior auricle separated from the disc by distinct suture, with 4-5 radial ridges and concentric lamellae, the latter strongly developed at dorsal margin. Byssal fasciole and notch well developed. Inactive and active ctenolium with 2-3 teeth. Resilifer triangular. Valves sometimes with a few white spots. External sculpture visible from the interior.

Remarks. — The present specimen is very similar to the holotype of *D. musorstomi* from the Philippines.

Poutiers (1981: 332) compared *Delectopecten musorstomi* with *D. polyleptus* (Dall, 1908), from the Galapagos Islands and Chile. Another related species is *D. fluctuatus* which has similar sculpture, though it is larger (up to 10 mm high) and the disc is undulating, and there are more numerous scaly radial lirae.

Subfamily Chlamydinae Teppner, 1922

Tribe Chlamydini Teppner, 1922

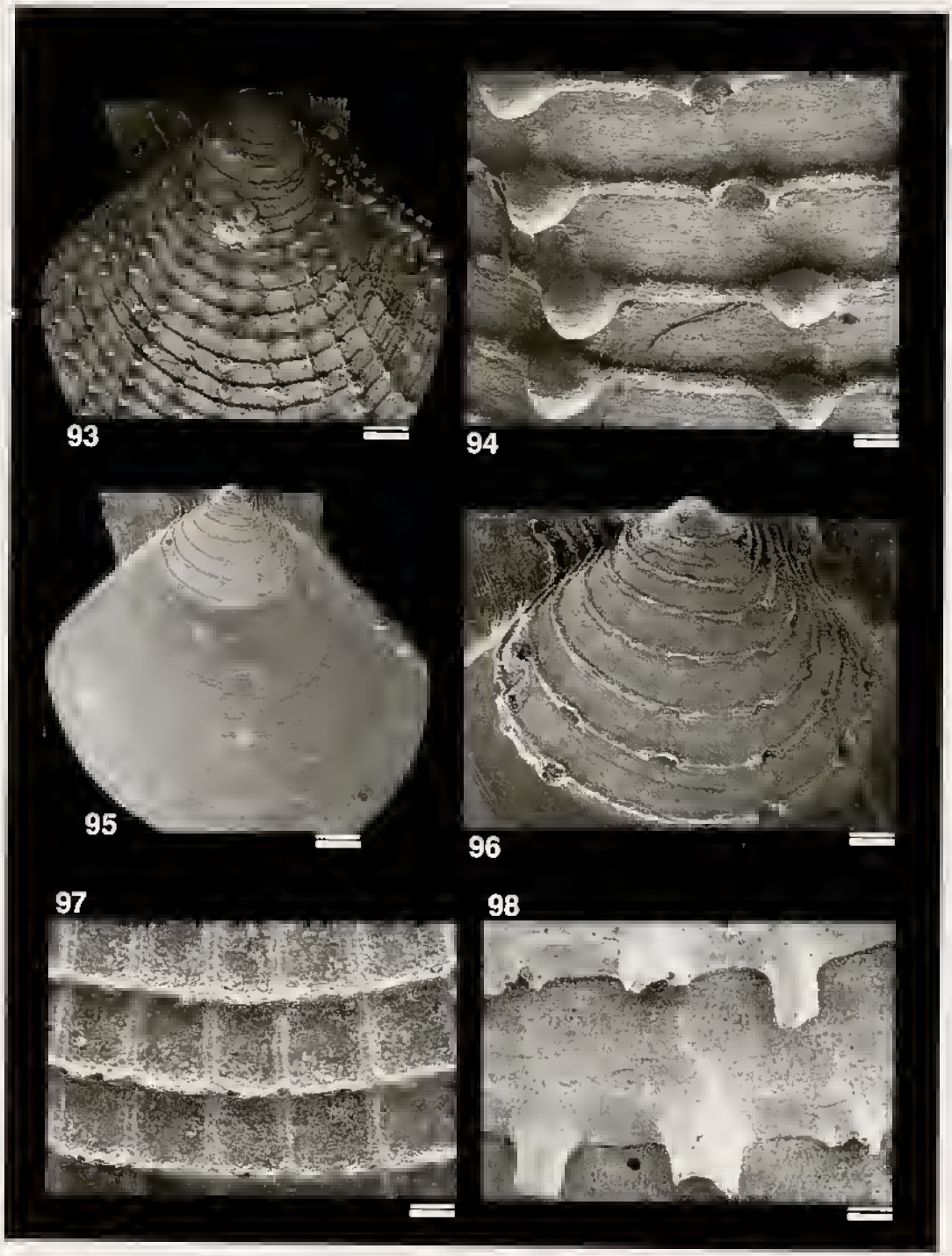
Diagnosis. — Chlamydinae with microsculpture of diverged striae (antimarginal); shagreen (reticulated) microsculpture present at least in early growth stages.

Genus *Laevichlamys* Waller, 1993

Laevichlamys Waller, 1993: 204. Type species (OD): *Pecten multisquamatus* Dunker, 1864; Recent, Cuba.

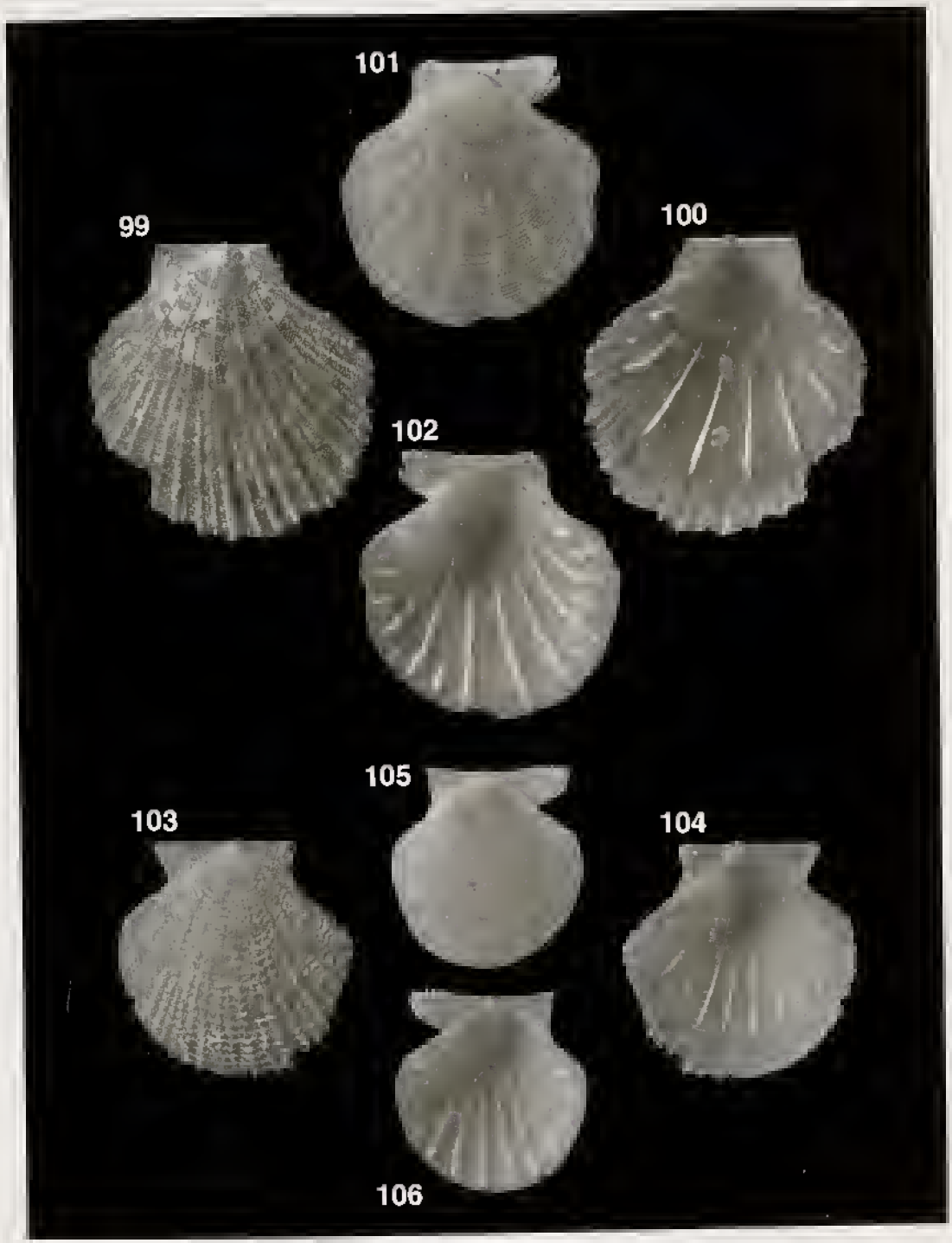
Diagnosis. — Byssate, non-cemented, free living Chlamydini; shagreen (reticulated) microsculpture absent; sculptured with closely spaced, weak radial costae on both valves; regular commarginal lirae absent; byssal notch with ctenolium.

Source : MNHN, Paris



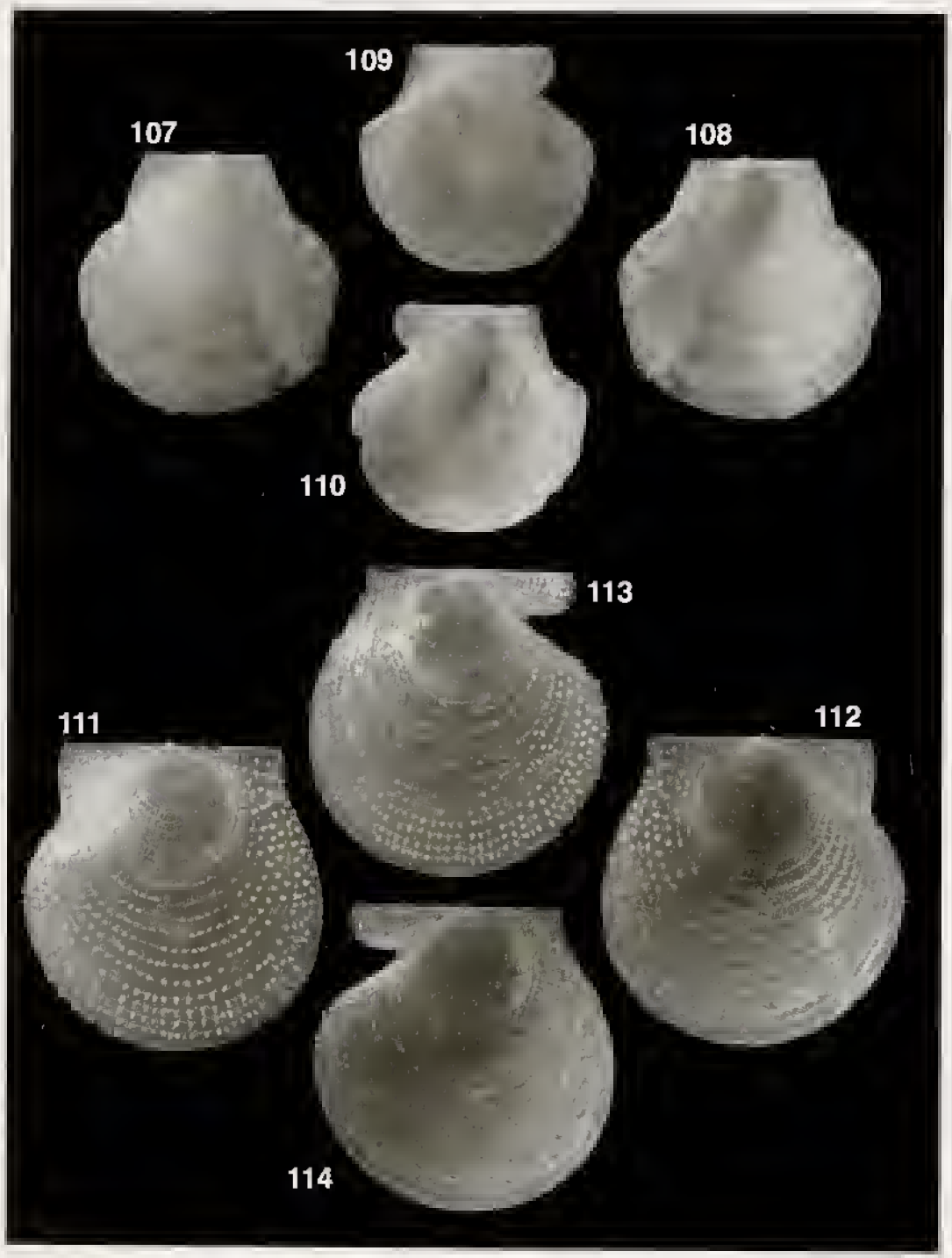
FIGS 93-98. — **93-96**, *Parvamussium vesiculatum*, BIOCAL: stn DW 44, paratypes. — **93**, left valve, exterior, scale bar 600 µm. — **94**, left valve, exterior, antero-marginal detail, scale bar 100 µm. — **95**, left valve, exterior, scale bar 600 µm. — **96**, left valve, exterior, dorsal region detail, scale bar 200 µm. — **97**, *P. retiolum*, MUSORSTOM 5: stn CP 363, paratype, left valve, exterior, central detail, scale bar 100 µm. — **98**, *Cyclopecten horridus*, BIOCAL: stn DW 08, left valve, exterior, postero-marginal detail, scale bar 50 µm.

Source : MNHN, Paris



FIGS 99-106. — **99-102**, *Parvamussium thetidis*, CHALCAL 2: stn DW 73, 10.0 x 9.8 mm (lv), 8.9 x 8.9 mm (rv). — **99**, left valve, exterior. — **100**, left valve, interior. — **101**, right valve, exterior. — **102**, right valve, interior. — **103-106**, *Parvamussium texturatum*, MUSORSTOM 5: stn DW 300, 6.5 x 6.6 mm (db). — **103**, left valve, exterior. — **104**, left valve, interior. — **105**, right valve, exterior. — **106**, right valve, interior.

Source : MNHN, Paris



FIGS 107-114. — **107-110**, *Parvamussium pauciliratum*, MUSORSTOM 5: stn DW 263, 8.2 x 8.1 mm (lv), 7.2 x 7.2 mm (rv). — **107**, left valve, exterior. — **108**, left valve, interior. — **109**, right valve, exterior. — **110**, right valve, interior. — **111-114**, *Delectopecten alcocki*, CORAIL 2: stn DE 14, 10.4 x 10.1 mm (db). — **111**, left valve, exterior. — **112**, left valve, interior. — **113**, right valve, exterior. — **114**, right valve, interior.

Source : MNHN, Paris

DISTRIBUTION. — Miocene to Recent. Indo-West Pacific and western Atlantic; littoral to sublittoral.

Laevichlamys kauaiensis Dall, Bartsch & Rehder, 1938

Figs 121-122

Chlamys kauaiensis Dall, Bartsch & Rehder, 1938: 92, pl. 22, figs 9-10.

Other references:
Chlamys kauaiensis — KAY, 1979: 525, figs 168 F-G. — EARLE, 1985: 1, 4, fig.

TYPE MATERIAL. — Holotype, rv, USNM 335674.

TYPE LOCALITY. — Off Hanamaulu warehouse, Kauai, Hawaii Islands, *"Albatross"*, stn 4132, 470-571 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DW 329, 20°23' S, 158°47' E. 320 m, 1 rv. — Stn DC 388, 20°45' S, 160°54' E, 500-510 m, 1 rv.
New Caledonia. *"Vauban"* 1978-79: stn 40, 22°30' S, 166°24' E, 250-350 m, 1 rv.

DISTRIBUTION. — Hawaiian Islands (DALL, BARTSCH & REHDER, 1938; KAY, 1979; EARLE, 1985), now also Chesterfield Islands and New Caledonia. Present material taken dead at 250-510 m.

DESCRIPTION. — *Shell* small, up to ca. 6 mm high, fragile, suborbicular, equivalve, right valve slightly more convex than left, anterior and posterior auricles very unequal in size, umbonal angle 90-95°.

Prodissoconch ca. 240 µm in height.

Left valve sculptured with 24-28 fine regularly spaced radial riblets, with delicate scales (often eroded). Microscopic diverging scratches between radial riblets. Auricles sculptured with 3 or 4 scaly axial riblets that are somewhat more prominent on anterior. Hinge line straight.

Right valve sculptured like the left. Anterior auricle with 5 or 6 scaly radial scaly. Antero-dorsal margin strongly denticulate. Posterior auricle narrow, with 3 or 4 spinous riblets. Byssal fasciole and notch well developed. Inactive and active ctenolium with 4-6 teeth. Resilifer triangular. Anterior resilial tooth more prominent than posterior. Internal plicae extending from central sector to ventral margin.

Left and right valves usually cream, white or bright yellow or orange-red, sometimes with small white spots.

REMARKS. — The present specimens are very similar to the holotype of *L. kauaiensis*, although somewhat more brightly coloured, with slightly stronger sculpture on the posterior auricle of the right valve. *L. kauaiensis* is rather variable in radiation and coloration.

Also similar to *L. kauaiensis* is *L. allorenti* (Dijkstra, 1988) from Réunion and adjacent areas (see DIJKSTRA, 1988: 21).

Genus *VEPRICHLAMYS* Iredale, 1929

Veprichlamys Iredale, 1929: 164, 188 [Proposed as a subgenus of *Mimachlamys*]. Type species (OD): *Chlamys perillustris* Iredale, 1925; Recent, off Victoria, Australia, 274-457 m.

DIAGNOSIS. — Non-cemented thin Chlamydini, obliquely oval; slender radial costae with prickly lamellae, interstices broad with or without secondary radial riblets; microsculpture longitudinal or diverged scratches; auricles very unequal; inner ribs undulated, lacking carinae; byssal notch well-developed with ctenolium.

DISTRIBUTION. — ?Miocene to Recent, Pacific Ocean, including New Zealand and the Galapagos Islands; 120-1280 m (DIJKSTRA, unpubl. data).

Source : MNHN, Paris

Veprichlamys kiwaensis Powell, 1933

Figs 119-120

Chlamys kiwaensis Powell, 1933: 371, pl. 40, figs 1-5.

Other reference:

Chlamys kiwaensis – Powell, 1979: 378, pl. 72, fig. 14.

Type material. — Holotype live taken, aim AK70167.

Type locality. — 400 miles W of New Plymouth, New Zealand, 39°00′ S, 168°50′ E, 1097-1280 m.

Material examined. — **New Zealand**. Off Taiaroa Heads, 475-640 m, 2 v (nmnz M9138). — 41°35′ S, 174°53′ E, Palliser Bay, 366-549 m, 5 spms (nmnz M9850). — 44°45.6′ S, 171°05′ E, off Taiaroa Heads, 549 m, 2 v (nmnz M12827). — 41°30.7′ S, 174°58.4′ E, Turakirae Trench, Cook Strait, 448-512 m, 7 spms (nmnz M29148). — 41°30.5′ S, 174°54′ E, Turakirae Trench, Cook Strait, 640-658 m, 3 spms (nmnz M29129). — 43°14′ S, 173°39′ E, Pegasus Canyon, off Banks Peninsula, 512-1006 m, 18 spms + many valves (nmnz M52769). — 42°35′ S, 173°41′ E, off Kaikoura, 640 m, 5 spms (nmnz M53676). — 41°55.9′ S, 174°43.2′ E, off Cape Campbell, 424-454 m, 14 spms (nmnz M59679). — 41°55.8′ S, 174°40.7′ E, SE of Cape Campbell, 434-446 m, 10 spms + many valves (nmnz M60407). — 37°22.0′ S, 176°28.5′ E, off Mayor I., 388-448 m, 2 spms (nmnz M60094). — Conway Rise, Kaikoura, 400 m, 10 spms (nmnz M76106).
New Caledonia. musorstom 4: stn DW 225, 22°52′ S, 167°23′ E, 590-600 m, 1 rv.

Distribution. — New Zealand, living in 366-1006 m; New Caledonia, taken dead at 590-600 m.

Description. — *Shell* equivalve, up to ca. 35 mm in height, suborbicular to oblique, compressed, fragile, auricles strongly unequal.

Valves sculptured with 20-24 scabrous radial costae, interspaces with *Camptonectes*-like radial striae, sometimes absent in late growth stages. Anterior auricle of left valve sculptured with 8 radial riblets, 5 on right valve; posterior auricles nearly smooth.

Byssal notch well-developed, with ctenolium. Colour outside dull-white or creamy, sometimes with the radials brownish-pink; inside nacreous.

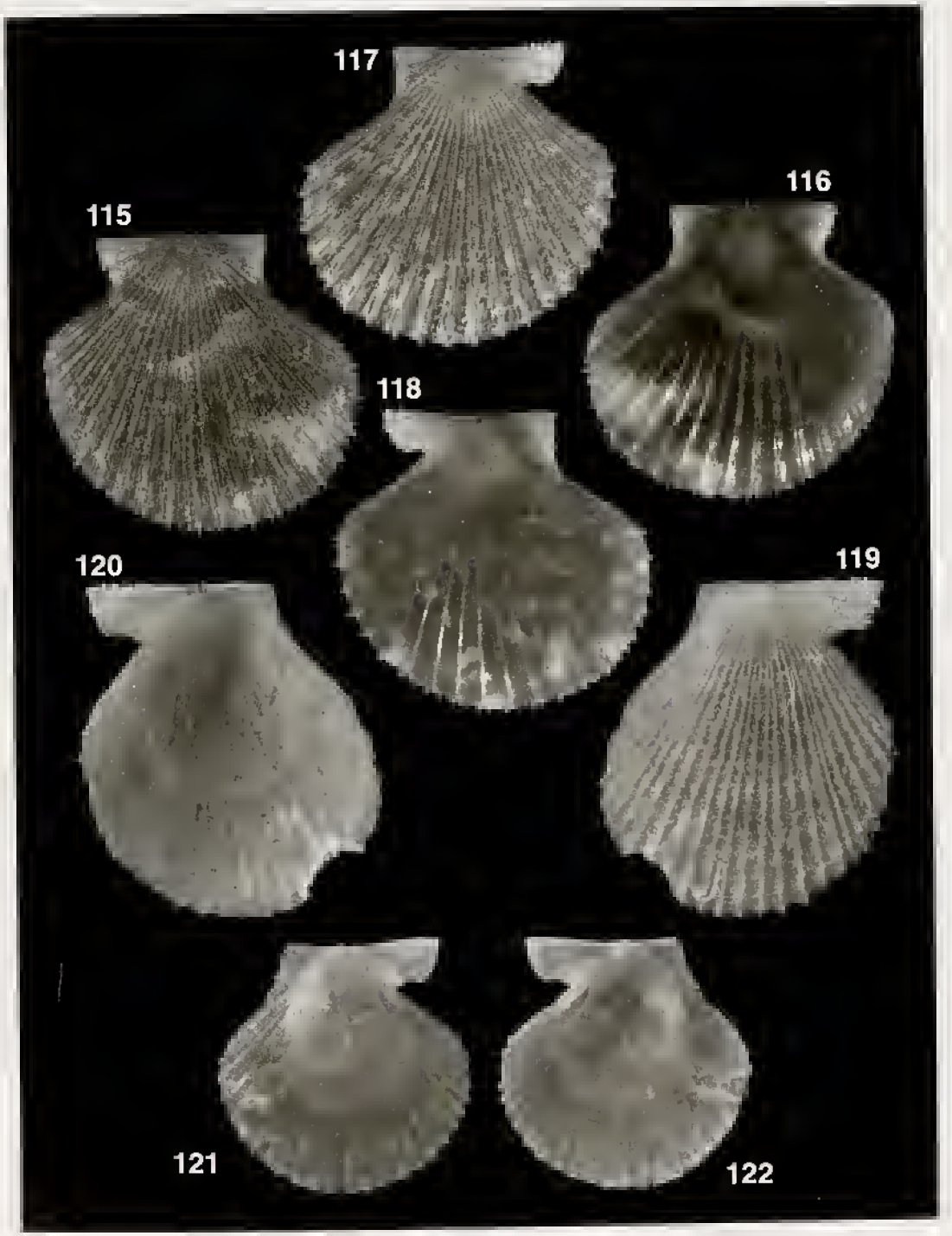
Remarks. — The present material from off New Caledonia is very similar to the type specimens of *C. kiwaensis* from New Zealand, although smaller (height 12 mm). The microscopic diverging striae between the radial costae ("*Camptonectes*" – like divarications of Powell's description) are strongest near the antero-lateral margin in the present material, and absent near the ventral margin.

Related species are *Veprichlamys jousseaumei* Bavay, 1904 from southern Japan to Indonesia, *V. perillustris* from SE and S Australia, and *V. incantata* (Hertlein, 1972) from the Galapagos Islands. Waller (1993: 236) mentioned also *V. onzola* (Olsson, 1964), a Neogene species from northwestern Ecuador. *V. jousseaumei* is slightly orbicular in shape, and has numerous radial costae (30-38). *V. perillustris* is more oblique, and has fewer radial costae (20-26), which are more strongly imbricated. *V. incantata* is larger (height up to ca. 55 mm), less obliquely oval, and sculptured with ca. 20 radial costae and interstitial radial riblets.

Tribe Aequipectinini Nordsieck, 1969

Diagnosis. — Chlamydinae with complex sculpture of radiating costae, regularly lamellose with series of hollow chambers or secondary interstitial concentric lamellae, equilateral and auricles more equal in late growth stages.

Source : MNHN, Paris



FIGS 115-122. — **115-118**, *Cryptopecten bullatus*, MUSORSTOM 6: stn CP 464, 15.9 x 17.0 mm (db). — **115**, left valve, exterior. — **116**, left valve, interior. — **117**, right valve, exterior. — **118**, right valve, interior. — **119-120**, *Veprichlamys kiwaensis*, MUSORSTOM 4: stn DW 225, 12.2 x 10.8 mm (rv). — **119**, right valve, exterior. — **120**, right valve, interior. — **121-122**, *Laevichlamys kauaiensis*, *"Vauban"* 1978-79: stn 40, 6.9 x 6.9 mm (rv). — **121**, right valve, exterior. — **122**, right valve, interior.

Source : MNHN, Paris

Genus *Cryptopecten* Dall, Bartsch & Rehder, 1938

Cryptopecten Dall, Bartsch & Rehder, 1938: 93. Type species (OD): *Cryptopecten alli* Dall, Bartsch & Rehder, 1938; Recent, off Hawaii, 95-435 m.

Synonym:

Corymbichlamys Iredale, 1939: 367.Type species (OD): *Chlamys corymbiatus* Hedley, 1909; Recent, off Queensland, Australia, 9-18 m.

Diagnosis. — *Shell* small, orbicular, convexity variable, laterally compressed, auricles nearly equal; *valves* sculptured with 12-25 radial costae, regularly lamellose, interspaces with fine imbricated scales; auricles sculptured with a few radial riblets; byssal notch well-developed and moderately deep, with ctenolium.

Distribution. — Lower Miocene-Recent. Indo-Pacific, western Atlantic; upper shelf to upper bathyal (Hayami 1984: 116).

Cryptopecten bullatus (Dautzenberg & Bavay, 1912)

Figs 115-118

Pecten (Chlamys) bullatus Dautzenberg & Bavay, 1912: 17, pl. 27, figs 1-2.

Synonyms:

Cryptopecten alli Dall, Bartsch & Rehder, 1938: 93, pl. 23, figs 1-4, 7.
Cryptopecten complanus Wang, 1983: 402, 405, figs 1.1-7.

Other references:

Chlamys (Aequipecten) tissotii — Kuroda, 1932: app. 95.
Chlamys alli — Kay, 1979: 524, fig. 168A.
Cryptopecten bullatus — Hayami, 1984: 96, pl. 1, figs 1-6, pl. 2, figs 1-3, pl. 9, fig. 1, pl. 10, fig. 3, pl. 11, fig. 3; Wagner, 1989: 60, figs 14-16. — Dijkstra, 1991: 35; 1992: 26, figs 1-4.

Type material. — *C. bullatus*: holotype, live taken, ZMA 3.12.006, 2 paratypes ZMA 3.12.007. — *C. alli*: holotype, live taken, USNM 173194. — *C. complanus*: holotype, live taken, IOAS M11072, paratype IOAS M11073.

Type locality. — *C. bullatus*: Sulu Archipelago, Philippines, "*Siboga*", stn 105, 6°08' N, 121°19' E, 275 m. — *C. alli*: South coast of Oahu, Hawaii Islands, "*Albatross*", stn 3811, 436-461 m. — *C. complanus*: East China Sea, 31°05' N, 128°00' E, 147 m.

Material examined. — The type material.
Chesterfield Islands. CHALCAL 1: stn D 35, 19°45' S, 158°26' E, 210 m, 1 lv.
MUSORSTOM 5: stn DW 255, 25°15' S, 159°55' E, 280-295 m, 3 lv. — Stn DW 258, 25°33' S, 159°46' E, 300 m, 1 spm. — Stn DW 277, 24°11' S, 159°35' E, 270 m, 1 rv. — Stn CP 279, 24°09' S, 159°38' E, 260-270 m, 1 lv. — Stn CP 289, 24°02' S, 159°38' E, 273 m, 2 lv. — Stn DW 299, 22°48' S, 159°24' E, 360-390 m, 1 lv, 1 rv. — Stn DW 306, 22°08' S, 159°21' E, 375-415 m, 2 lv, 1 rv. — Stn DW 328, 20°23' S, 158°44' E, 340-355 m, 1 rv. — Stn DC 388, 20°45' S, 160°54' E, 500-510 m, 1 lv.
CORAIL 2: stn DW 114, 19°25' S, 158°38' E, 217 m, 1 lv, 1 rv. — Stn DW 129, 19°28' S, 158°34' E, 215 m, 1 rv. — Stn CP 131, 19°25' S, 158°38' E, 215-217 m, 1 lv.
New Caledonia. "*Vauban*" 1978-79: stn 33, 22°33' S, 166°25' E, 290-350 m, 1 lv. — Stn 37, 22°32' S, 166°26' E, 175-250 m, 1 rv. — Stn 40, 22°30' S, 166°24' E, 250-350 m, 1 lv.
BIOCAL: stn CP 105, 21°31' S, 166°22' E, 330-335 m, 1 lv.
MUSORSTOM 4: stn DW 219, 23°03' S, 167°33' E, 760 m, 1 rv.

Source : MNHN, Paris

SMIB 2: stn DW 14, 22°53′ S, 167°13′ E, 405-444 m, 1 spm.
SMIB 5: stn DW 77, 23°41′ S, 168°01′ E, 270 m, 1 spm. — Stn DW 91, 22°18′ S, 168°41′ E, 340 m, 1 rv. — Stn DW 92, 22°20′ S, 168°41′ E, 280 m, 1 rv. — Stn DW 98, 23°02′ S, 168°16′ E. 335 m, 1 lv. — Stn DW 105, 23°14′ S, 168°05′ E, 310 m, 1 lv.
Loyalty Islands. MUSORSTOM 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 1 spm, 2 rv. — Stn DW 392, 20°47′ S, 167°05′ E, 340 m, 1 rv. — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 1 lv. — Stn DW 406, 20°41′ S, 167°07′ E, 373 m, 1 spm, 1 lv. — Stn DW 416, 20°42′ S, 166°60′ E, 343 m. 3 rv. — Stn DW 421, 20°26′ S, 166°40′ E, 245 m, 1 rv. — Stn DW 428, 20°24′ S, 166°13′ E, 420 m, 1 rv. — Stn DW 457, 21°00′ S, 167°29′ E, 353 m, 2 lv, 2 rv. — Stn DW 459, 21°01′ S, 167°31′ E, 425 m, 1 spm, 1 lv, 1 rv. — Stn DW 464, 21°02′ S, 167°32′ E, 430 m. 3 spms, 4 lv. — Stn DW 479, 21° 09′ S, 167°55′ E, 310 m, 1 lv, 2 rv. — Stn DW 480, 21°09′ S. 167°56′ E, 380 m, 1 rv. — Stn DW 481, 21°22′ S, 167° 50′ E, 300 m, 1 lv. — Stn DW 485, 21°23′ S, 167°59′ E, 350 m, 1 rv. — Stn DW 487, 21°23′ S, 167°46′ E, 500 m. 1 spm.
New Hebrides Arc. VOLSMAR: stn DW 7, 22°26′ S, 171°44′ E, 325-400 m, 2 spms, 2 lv, 2 rv. — Stn DW 8, 22°25′ S, 171°43′ E, 630 m, 1 fragm. lv. — Stn DW 9, 22°23′ S, 171°42′ E, 275-300 m, 1 lv. — Stn DW 16, 22°25′ S, 171°41′ E, 420-500 m. 1 lv, 1 rv. — Stn DW 17, 22°23′ S, 171°42′ E, 260-300 m, 1 spm. — Stn DW 38. 22°22′ S, 168°43′ E, 380-420 m, 1 lv.

DISTRIBUTION. — Throughout the western, southwestern and central Pacific, western Indian Ocean, Chesterfield Islands, New Caledonia, Loyalty Islands and New Hebrides Arc. Present material living at 260-500 m.

DESCRIPTION. — *Shell* up to ca. 25 mm high, usually 20 mm, moderately thin, depressed, somewhat oblique towards posterior half, equivalve, inequilateral, right valve slightly more convex than left, auricles unequal in size, umbonal angle ca. 110°.

Prodissoconch ca. 230 µm in height.

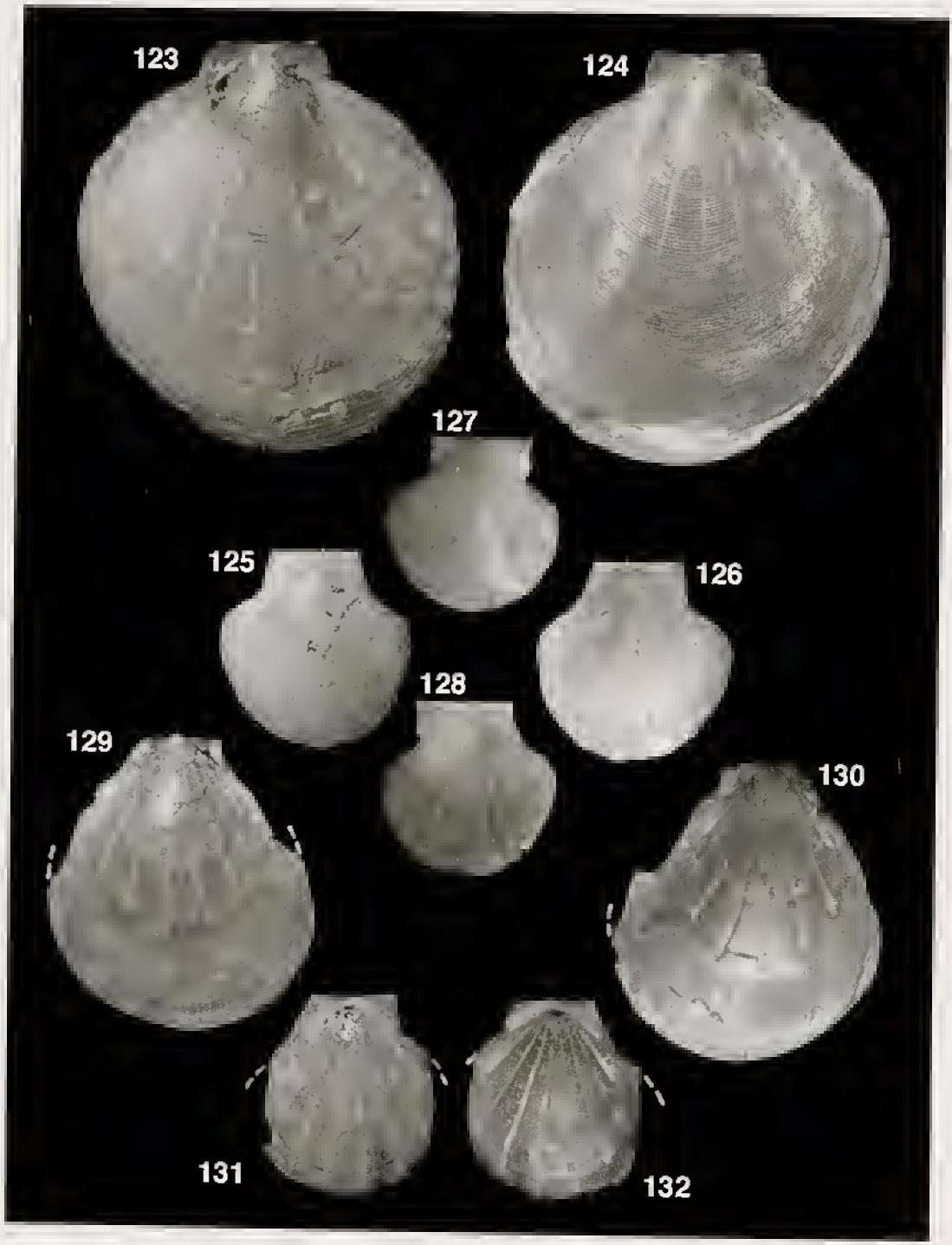
Left valve with 17-20 radial costae (commonly 18-19), commencing at 2 mm shell height and gradually enlarging, strong on central ridge, with numerous cavities on their sides. Interspaces commonly narrower than costae, finely lamellate. Anterior auricle slightly larger than posterior, sculptured with 2 prominent radial riblets and 2-4 interstitial radial riblets. Posterior auricle with 1 strong radial riblet and 3-5 smaller ones between disc margin. A few denticulated scales on antero — and postero-dorsal margins. Hinge line straight.

Right valve similar to that of left valve, with finer interstitial lamellae, and stronger denticulate scales on dorsal margin. Hinge line somewhat raised. Byssal fasciole relative small, byssal notch rather deep. Inactive and active ctenolium with 4 or 5 teeth. Antero — and postero-lateral margins of disc scarcely gaping. Resilifer elongate triangular. Inner surface of both valves strongly plicate.

Coloration very variable, commonly reddish brown with pale oblique or zigzag markings, sometimes uniform yellow or purple.

REMARKS. — The present material is very similar to the type specimens of *C. bullatus* from the Sulu Archipelago, but the latter have more radial costae (22). The auricles also have a lower number of radial riblets. The convexity and sculpture vary with the bathymetric range and geographic distribution. For further discussion see HAYAMI (1984: 98), WAGNER (1989: 61), and DIJKSTRA (1991: 36).

Source : MNHN, Paris

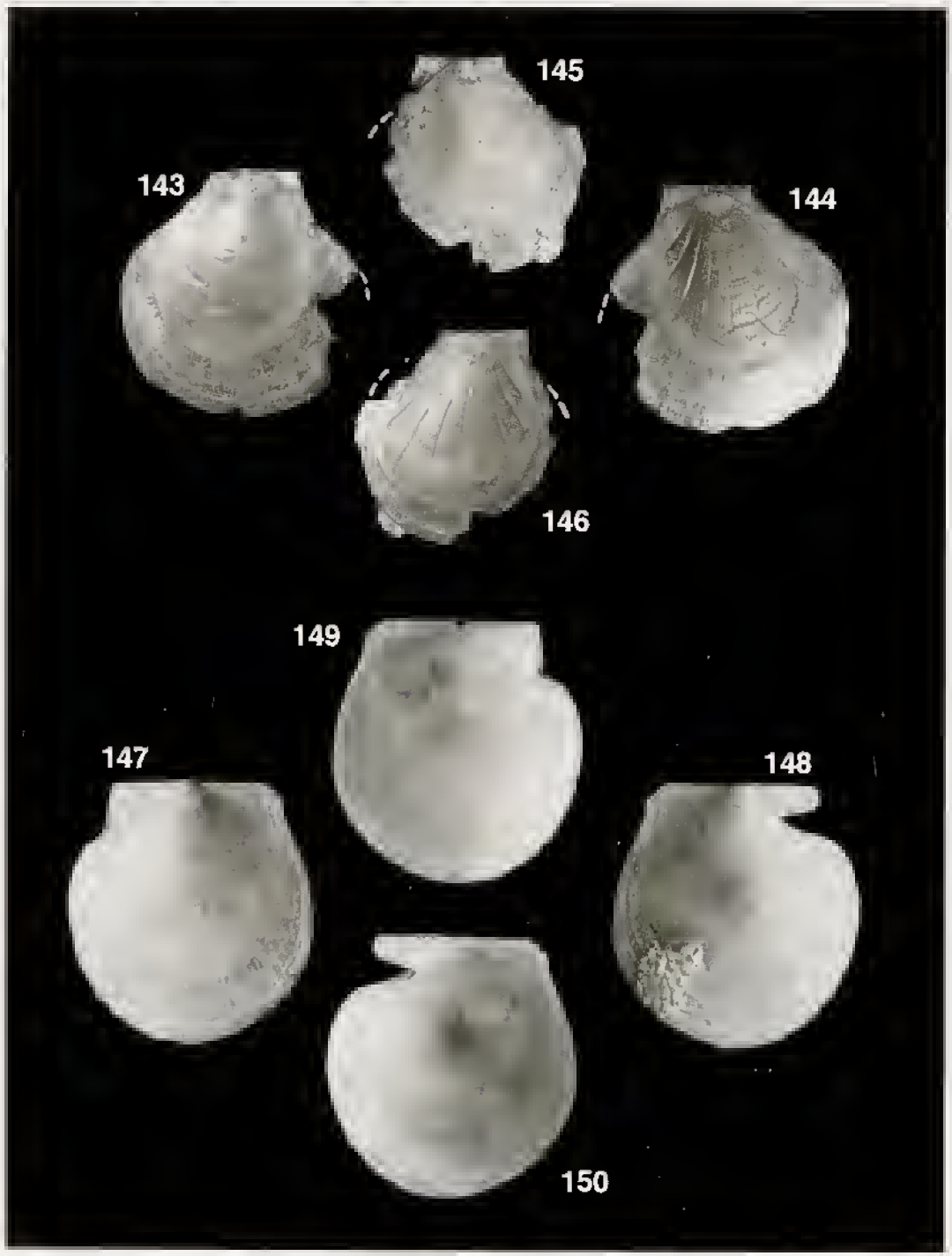


FIGS 123-132. — **123-124**, *Propeamussium watsoni*, lectotype, 51.8 x 50.0 mm (db). — **123**, left valve, exterior. — **124**, right valve, exterior. — **125-128**, *Parvamussium torresi*, lectotype, 7.8 x 7.9 mm (db). — **125**, left valve, exterior. — **126**, left valve, interior. — **127**, right valve, exterior. — **128**, right valve, interior. — **129-132**, *Propeamussium caducum*, lectotype, 20.9 x 18.8 mm (db). — **129**, left valve, exterior. — **130**, left valve, interior. — **131**, right valve, exterior. **132**, right valve, interior.

Source : MNHN, Paris

FIGS 133-142. — **133-137**, *Propeamussium alcocki*, lectotype, 40.4 x 39.8 mm (db). — **133**, original label. — **134**, left valve, exterior. — **135**, left valve, interior. — **136**, right valve, exterior. — **137**, right valve, interior. — **138-142**, *Propeamussium andamanicum*, lectotype, 30.2 x 22.4 mm (db). — **138**, original label. — **139**, left valve, exterior. — **140**, left valve, interior. — **141**, right valve, exterior. — **142**, right valve, interior.

Source : MNHN, Paris



FIGS 143-150. — **143-146**, *Propeamussium meridionale*, lectotype, 13.8 x 13.4 mm (db). — **143**, left valve, exterior. — **144**, left valve, interior. — **145**, right valve, exterior. — **146**, right valve, interior. — **147-150**, *Delectopecten alcocki*, lectotype, 19.0 x 18.0 mm (db). — **147**, left valve, exterior. — **148**, right valve, exterior. — **149**, left valve, interior. — **150**, right valve, interior.

Source : MNHN, Paris

FIGS 151-154. — **151-152**, *Parvamussium pauciliratum*, lectotype, 7.5 x 7.4 mm (db). — **151**, left valve, exterior. — **152**, right valve, exterior. — **153-154**, *Parvamussium scitulum*, lectotype, 4.4 x 4.5 mm (lv). — **153**, left valve, exterior. — **154**, left valve, interior.

DISCUSSION

Thirty species of Pectinoidea are now known from the Chesterfield Islands, New Caledonia and the Loyalty Islands, at depths below 100 m. Including *Pseudohinnites levii*, which had been described earlier in a seperate paper, 10 species, precisely a third of the fauna, were undescribed before this survey. The collection studied here comprised 236 lots, *i.e.* 8.7 lots per species. Only 4 species (*Cyclopecten pellucidulus, Delectopecten fluctuatus, D. musorstomi* and *Veprichlamys kiwaensis*), or 13.3% of the total fauna, are known from a single sample. All these observations indicate that the fauna is probably now rather adequately sampled, at least at depths shallower than 1500 m. The bathymetric distribution of the species is summarized in Table 2. The highest diversity is in the 600-800 m depth interval, with 14 live-taken species; respectively 9 and 8 species have been taken alive in the 200-400 m and 400-600 m depths intervals. Below 800 m, the diversity drops to 4 species. Only 3 species (*Propeamussium meridionale, Parvamussium multiliratum* and *Pseudohinnites levii*) have been taken alive deeper than 1500 m, but this may reflect the fact that much fewer samples have been taken in very deep water.

Up to 4 species have been collected from a single station: MUSORSTOM 6: stn CP 438, 780 m (*Propeamussium alcocki* and *P. watsoni*, alive; *Hyalopecten mireilleae* and *Pseudohinnites levii*, dead). A maximum of 2 species have been collected alive in a single station. However, ca. 70% of the stations with pectinoids contain a single species.

Source : MNHN, Paris

TABLE 2. — Bathymetric range of deep-water Pectinoidea from the New Caledonia region and Indonesia. Thick bar: confirmed living depth range; thin line: depth range indicated by empty shells only. Solid black: data for New Caledonia; stippled: data for Indonesia.

Source : MNHN, Paris

TABLE 3. — Occurence and abundance of Pectinoidea in deep-water off Indonesia and New Caledonia.
Stn: number of stations where the species has been recovered.
Live/dead: number of specimens taken alive and dead respectively.

Species	Indonesia			NC region		
	Stn	live	dead	Stn	live	dead
Propcamussium alcocki	·	-	-	5	37	3
P. andamanicum	·	·	·	2	2	·
P. caducum	11	20	11	4	2	5
P. maorium	·	·	·	6	3	9
P. lacteum	1	·	2	-	-	-
P. meridionale	1	·	1	20	18	46
P. rubrotinctum	-	-	-	24	70	52
P. sibogai	1	1	-	15	23	12
P. siratama	1	·	1	·	·	-
P. watsoni	-	-	-	12	226	4
P. zoniferum	1	1	5	·	·	-
Parvamussium araneum	3	2	1	-	·	-
P. carbaseum	14	·	73	·	·	·
P. cassium	1	1	-	-	-	-
P. cristatellum	6	1	43	·	-	-
P. dautzenbergi	2	·	3	-	·	-
P. ina	1	-	3	·	·	·
P. margaritiferum	1	1	·	·	·	·
P. multiliratum	·	·	·	7	10	5
P. reticulum	·	·	·	4	7	6
P. reticulum	-	·	·	10	53	14
P. sciulum	14	·	>100	8	7	47
P. squalidulum	-	-	-	15	5	42
P. texturatum	3	2	1	5	3	8
P. thetidis	·	·	·	9	7	29
P. torresi	1	1	·	13	4	156
P. undisonum	·	·	·	4	2	6
P. undosum	5	·	6	-	·	-
P. vesiculatum	-	-	-	15	44	17
P. virgatum	3	·	5	-	-	-
Cyclochlamys favus	-	-	-	2	9	·
Cyclopecten bavayi	1	1	-	·	-	·
C. cancellus	6	·	15	-	·	-
C. horridus	·	·	-	4	1	7
C. pellucidulus	-	·	·	1	4	·
Simulipecten eous	3	·	7	·	·	-
Pectinella aequoris	2	·	5	5	1	4
Pseudolimnites levii	1	1	-	14	3	36
Caillopecten micaceus	1	1	-	·	-	-
C. translucens	1	1	·	-	·	-
Hyalopecten tydemani	2	-	2	·	-	-
H. circilleae	·	-	·	5	1	4
Delectopecten alcocki	1	-	1	2	1	2
D. fluctuatus	-	-	-	1	1	-
D. musorstomi	10	1	19	1	1	·
Laevichlamys kanaiensis	-	-	-	3	-	3
Veprichlamys kiwaensis	-	·	·	1	·	1
Cryptopecten bullatus	4	1	6	45	13	50

Source : MNHN, Paris

Cryptopecten bullatus is the species represented by the highest number of samples (45), followed by *Propeamussium rubrotinctum* (24) and *Propeamussium meridionale* (20). The species new to science are not particularly the rare ones: they are represented, as a mean, by 8.1 samples per species, with a minimum of 1, and a maximum of 15 samples.

Between 200 and 1000 m, propeamussiids are not only a diverse group, they may also be locally abundant as individuals, as the examples below indicate:

— *Propeamussium rubrotinctum*: Loyalty Islands, MUSORSTOM 6: stn DW 412, 437 m (> 50 spms).
— *Propeamussium watsoni*: Chesterfield Islands, MUSORSTOM 5: stn CP 323, 970 m (ca. 90 spms).
— *Parvamussium retiolum*: Chesterfield Islands, MUSORSTOM 5: stn CP 363, 685-700 m (40 spms).
— *Parvamussium vesiculatum*: New Caledonia, BIOCAL: stn DW 44, 440-450 m (37 spms).

The faunal assemblage from the Chesterfield Islands, New Caledonia and the Loyalty Islands may be compared to that of the Indonesian Archipelago (Tables 2 and 3). The sampling efforts are not directly comparable. In Indonesia, there are fewer than 150 deep-water stations (*"Siboga"*: 91 stations, *"Snellius-II"*: 54 stations), as compared to ca. 700 stations for the New Caledonia region. Conversely, the Indonesian Archipelago covers a larger geographical area, with more complex topography, than the New Caledonia region. However, several papers (DAUTZENBERG & BAVAY 1912; DIJKSTRA, 1990, 1991) cover the deep-water pectinoid fauna of Indonesia, and a comparison between the two faunal assemblages is not meaningless.

It is remarkable that, despite the difference in sampling intensity, Indonesia and New Caledonia have exactly the same number of deep-water pectinoids, 30 species. It is not less remarkable that only 12 species are shared: 60% of the pectinoids of New Caledonia are not recorded from Indonesia and *vice versa*. Considering the lower number of stations in Indonesia, it is not surprising that these 30 species are represented by fewer samples (Table 3): there is a total of 102 deep-water pectinoid samples, or 3.5 samples per species. As many as 14 species (46.7% of the fauna) have been recorded from Indonesia based on a single sample. This indicates a more highly diversified fauna, and it is very likely that additional species will be recorded when the sampling intensity increases.

TABLE 4. — Summary of faunal affinities on the deep-water Pectinoid fauna from the New Caledonian region.

Species shared with New Zealand	2	6.7%
Species shared with temperate Australia	2	6.7%
Species shared with tropical Indo-Pacific (of which: Species shared with Indonesia: 12)	17	56.6%
New species (actual distribution unknown, some may be endemic)	9	30.0%

Notwithstanding the relatively low proportion of species shared with Indonesia, the New Caledonia fauna consists mostly of species with larger Indo-West Pacific distribution (Table 4). Four species have a more restricted South-West Pacific distribution: *Parvamussium thetidis* and *Cyclochlamys favus* are shared with southern and eastern Australia, and *Propeamussium maorium* and *Veprichlamys kiwaensis* are shared with New Zealand.

Source : MNHN, Paris

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Source : MNHN, Paris

Source : MNHN, Paris

2

Systematic revision of living species of *Meiocardia*, Glossidae and *Glossocardia*, Trapezidae (Bivalvia)

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ABSTRACT

Living species of *Meiocardia*, Glossidae, are reviewed on the basis of specimens stored in various museums and institutions, including the MUSORSTOM collection of Museum national d'Histoire naturelle, Paris. Six species, one of them new, are reported from the Indo-West Pacific. The type species, *M. moltkiana* (Gmelin, 1791), has been variously interpreted by authors, so we redescribe it and give a new diagnosis of the genus. Other species of *Meiocardia* are: *M. sanguineomaculata* (Dunker, 1882) (Philippines to Seychelles); *M. vulgaris* (Reeve, 1845) (China to Philippines); *M. globosa* sp. nov. (eastern Indian Ocean to Taiwan and Philippines); *M. samarangiae* Bernard, Cai & Morton, 1993 (Japan); and *M. hawaiana* Dall, Bartsch & Rehder, 1938 (western Indian Ocean to Hawaii). *Meiocardia lamarckii* (Reeve, 1845) is synonymised with *M. moltkiana*. *Meiocardia lamarckii* of Japanese authors is not the same as *M. lamarckii* (Reeve), but is conspecific with *M. hawaiana*. *Meiocardia samarangiae* Bernard, Cai & Morton, 1993 is a replacement name for *Isocardia tetragona* Adams & Reeve, 1850 *non* Koch & Dunker, 1837.

The genus *Glossocardia*, Trapezidae, is redescribed on the basis of the type-species, *Glossocardia obesa* (Reeve, 1843) (tropical West Pacific). It includes *Glossocardia stoliczkana* Prashad, 1932 (Philippines and New Caledonia) and the tropical western Atlantic *G. agassizii* (Dall, 1886), which was originally assigned to *Meiocardia*. There are no records of living or fossil species of *Meiocardia* from the western Atlantic or eastern Pacific.

MATSUKUMA, A. & HABE, T., 1995. — Systematic revision of living species of *Meiocardia*, Glossidae and *Glossocardia*, Trapezidae (Bivalvia). *In*: P. BOUCHET (ed.), Résultats des Campagnes MUSORSTOM, Volume 14. *Mém. Mus. natn. Hist. nat.*, 167: 75-106. Paris ISBN 2-85653-217-9.

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Source : MNHN, Paris

RÉSUMÉ

Révision systématique des espèces actuelles de *Meiocardia* (Glossidae) et *Glossacardia* (Trapezidae) (Mollusca: Bivalvia).

Les espèces actuelles de *Meiocardia* (Glossidae) sont révisées sur la base du matériel conservé dans divers musées et instituts, y compris les collections constituées pendant les campagnes MUSORSTOM. Six espèces, dont une nouvelle, sont reconnues dans la région Indo-Ouest-Pacifique. L'espèce-type, *M. moltkiana* (Gmelin, 1791), a été diversement interprétée dans la littérature; nous la redécrivons donc, et donnons une diagnose révisée du genre. Les autres espèces de *Meiocardia* sont : *M. sanguineomaculata* (Dunker, 1882) (des Philippines aux Seychelles) ; *M. vulgaris* (Reeve, 1845) (de la Chine aux Philippines) ; *M. globosa* sp. nov. (de l'Est de l'océan Indien à Taiwan et aux Philippines) ; *M. samarangiae* Bernard, Cai & Morton, 1993 (du Japon) ; et *M. hawaiana* Dall, Bartsch & Rehder, 1938 (de l'ouest de l'océan Indien à Hawaï). *Meiocardia lamarckii* (Reeve, 1845) est mis en synonymie de *M. moltkiana*, mais *M. lamarckii* des auteurs japonais est un synonyme de *M. hawaiana*. *Meiocardia samarangiae* Bernard, Cai & Morton, 1993 est un nom de remplacement pour *Isocardia tetragona* Adams & Reeve, 1850, *non* Koch & Dunker, 1837.

Le genre *Glossocardia* (Trapezidae) est redécrit sur la base de son espèce-type, *G. abesa* (Reeve, 1843) (du Pacifique Ouest tropical). Ce genre comprend également *Glossacardia stoliczkana* Prashad, 1932 (des Philippines et de Nouvelle-Calédonie), et *G. agassizii* (Dall, 1886), de l'Atlantique tropical américain, décrite à l'origine comme *Meiocardia*. On ne connaît aucun *Meiocardia*, actuel ou fossile, dans le Pacifique oriental ou l'Atlantique américain.

INTRODUCTION

The bivalve family Glossidae is characterized by trapezoidal to cordiform shells with a cyprinoid hinge and conspicuous enrolled prosogyrous beaks. There are several living species belonging in two genera, *Glossus* and *Meiocardia*. Almost all living species of *Meiocardia* are restricted to the Indo-West Pacific. However, DALL (1886) described a living species from the tropical western Atlantic under the name *Meiocardia agassizii*.

Several fossil species from the Miocene of the Netherlands (JANSSEN, 1984), Tertiary of Piemonte, Italy (SACCO, 1900), and the Eocene of California (SQUIRES & ADVOCATE, 1986) and North Carolina (HARRIS, 1919a, b) have been included in *Meiocardia*. The taxonomic position of these fossil and living species from the Atlantic and the eastern Pacific is reassessed below.

Although several investigators, including REEVE (1845), ROEMER (1868), BUELOW (1906), LAMY (1920) and PRASHAD (1932), have reviewed the living species of *Meiocardia*, the taxonomy of Glossidae is still confused. For example, some authors have considered *Meiocardia moltkiana*, the type species of *Meiocardia*, to be strongly ribbed, with conspicuous nodules on the keel and a distinct sinuation just anterior to the keel (REEVE, 1845; ADAMS & REEVE, 1850; BUELOW, 1906), whereas Japanese authors have adopted the name for a species with an antero-posteriorly elongated, thick shell with a sharp keel lacking conspicuous nodules (OKUTANI & MATSUKUMA, 1982), and other authors have illustrated a shell with rounded postero-dorsal margin as this species (KEEN & CASEY, 1969; ABBOTT & DANCE, 1982).

We review living species of *Meiocardia*, Glossidae, based on the MUSORSTOM collection in Muséum national d'Histoire naturelle, Paris; National Science Museum, Tokyo; Institute of Systematics and Population biology, Universiteit van Amsterdam; Natural History Museum, London; Museum of Comparative Zoology, Harvard University; Academy of Natural Sciences, Philadelphia; Los Angeles County Museum, and others.

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

ANSP : Academy of Natural Sciences, Philadelphia, Pennsylvania
BMNH : The Natural History Museum, London
IC : Mr Hiroshi Ito's private collection, Tokyo
IMT : Institute of Malacology of Tokyo, Tanashi

Source : MNHN, Paris

KPM : Kanagawa Prefectural Museum, Yokohama
LACM : Los Angeles County Museum of Natural History, Los Angeles, California
MCZ : Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
MNHN : Museum national d'Histoire naturelle, Paris
NSMT : Department of Zoology, National Science Museum, Tokyo
SBMNH : Santa Barbara Museum of Natural History, Santa Barbara, California
USNM : National Museum of Natural History, Washington, DC
YC : Mrs Yoshie Yamasaki's private collection, Nagoya
ZMA : Institute of Systematics and Population Biology (Zoölogisch Museum), Universiteit van Amsterdam, Amsterdam

Measurements (Fig. 1):

Cb : Convexity of both valves
Cs : Convexity of single valve
H : Shell height
L : Shell length
lv : left valve
rv : right valve
V : valve.

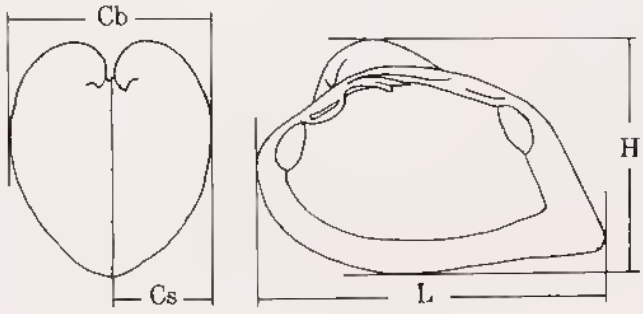


FIG. 1. Shell measurements of *Meiocardia* and *Glossocardia*. **Cb**, convexity of both valves. **Cs**, convexity of single valve. **H**, shell height. **L**, shell length.

SYSTEMATIC ACCOUNT

Family GLOSSIDAE Gray, 1847

DIAGNOSIS. – *Shell* rounded to cordiform, strongly inequilateral, equivalve, with strongly enrolled, prosogyrous beaks. Ventral margin not gaping, smooth. Ligament external, opisthodetic, parivincular. *Hinge* with two lamellar cardinals and two laterals. Outer surface ornamented with commarginal sculpture. Dimyarian, with subequal adductor muscles. Pallial line simple, without sinus.

REMARKS. – The family Glossidae is apparently very close to the family Trapezidae, but differs from the latter by having a glossy shell and by lacking radial sculpture and microscopic scales on the outer surface.

Genus *MEIOCARDIA* H. & A. Adams, 1857

Meiocardia H. & A. Adams, 1857: 461. Type species: *Bucardia moltkiana*, Chem[nitz] [as listed by H. & A. Adams] = *Meiocardia moltkiana* Spengler [as cited by Stoliczka] = *Chama moltkiana* Gmelin, 1791, subsequently designated by STOLICZKA, 1870: 187.

Source : MNHN, Paris

DIAGNOSIS. — *Shell* small, usually less than 50 mm long, cordiform, strongly inflated, strongly inequilateral, equivalve. Beaks prominent, prosogyrous, strongly incurved. Larval ligament anterior to beaks. Outer surface glossy or polished, ornamented with commarginal sculpture. A strong primary keel from beak to lower posterior end separating posterior slope; weak secondary keel from beak to upper posterior end separating postero-dorsal margin. Cardinals (1, 3a, 3b) and laterals (LAI, LAIII, LPI, LPIII) in the right valve; cardinals (2a, 2b, 4b) and laterals (LAII, LPII) in the left valve. Posterior laterals (LPI, LPII, LPIII) finely striated or nodulated (Figs 1-2, 4-5).

REMARKS. — All living species of the Glossidae are placed in either *Glossus* Poli, 1795, or *Meiocardia*. *Meiocardia* clearly differs from *Glossus* in the having a smaller, subquadrate shell with very thin periostracum and a prominent primary keel separating the posterior slope. The genus *Glossus* includes only one living species, *G. humanus* (Linnaeus, 1758) of the Mediterranean to northeastern Atlantic, and is characterized by having a large, rounded shell with thick, reddish-brown periostracum and in lacking a dorsal keel. *Isocardia* Lamarck, 1799 is an objective junior synonym of *Glossus* Poli, 1795.

Meiocardia moltkiana (Gmelin, 1791)

Figs 3-4, 24-28

Chama Moltkiana Gmelin, 1791 [ex CHEMNITZ, non binominal]: 3303-3304.

Synonyms:

Isocardia lamarckii Reeve, 1845: *Isocardia* sp. 5, pl. 1, fig. 5 [China].
Meiocardia nishimurai Kosuge & Kase, 1994: 28-29, pl. 11, figs 1-5 [Bonin (= Ogasawara) Islands, Japan]. **(Syn. nov.)**.

Other references:

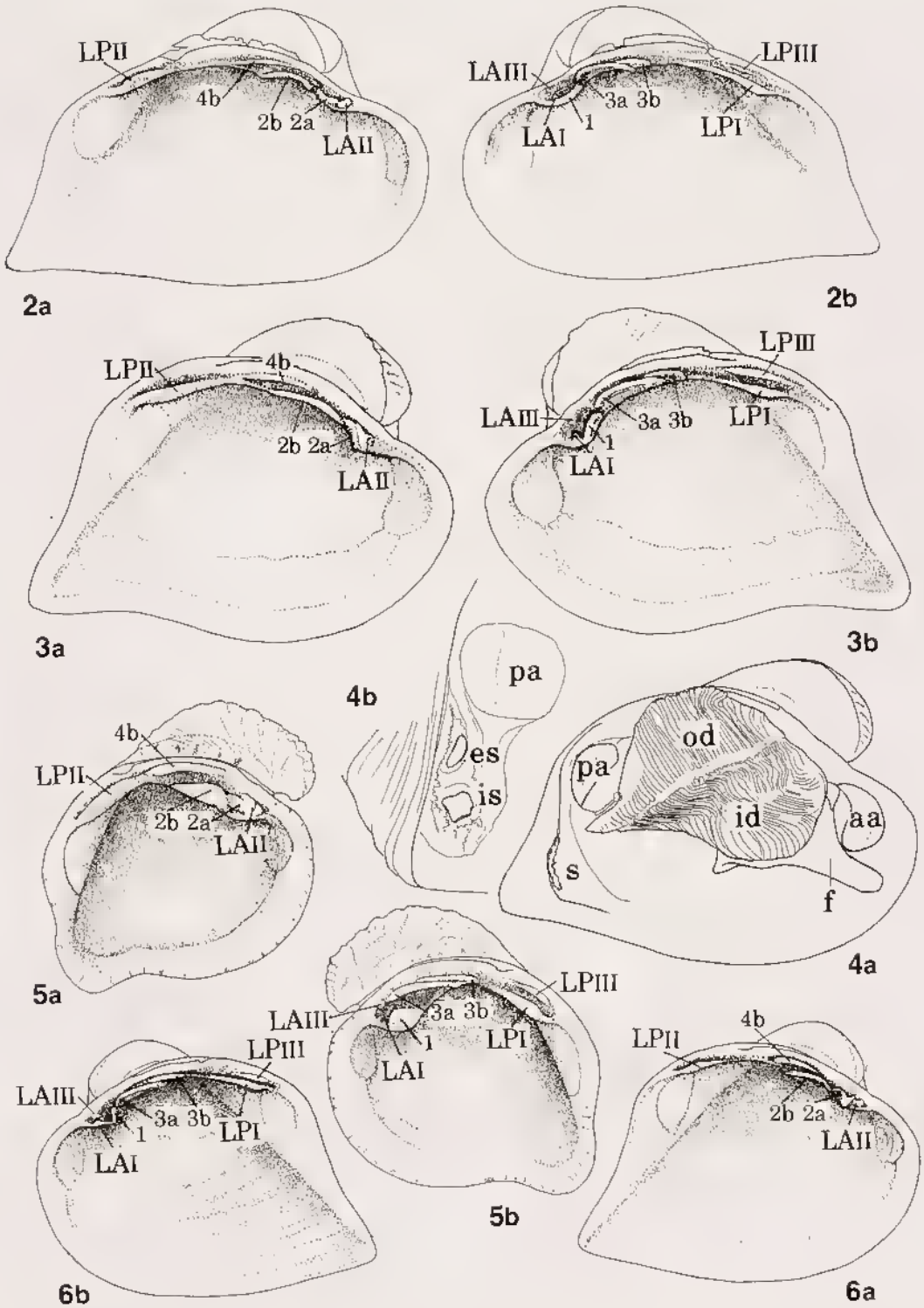
"Die Moltkische *Chama*" Spengler, 1783: 321-325, pl. 14, figs 1-4 [South Seas; invalid, not latinized].
Chama Moltkiana Chemnitz, 1784: 105-108, pl. 48, figs 484-487 [Ostindien; appeared in invalid work]. — BRUGUIÈRE, 1797: pl. 233, figs 1a-d [fig. only].
Isocardia moltkiana – LAMARCK, 1819: 31 [India, China]. — BORY DE ST. VINCENT, 1827: 149.
Isocardia lamarckii – HANLEY, 1856: appendix, 370-371, app. pl. 18, f. 34 [China]. — BUELOW, 1906: 7-8, pl. 8, figs 6a-b. — LAMY, 1911: 132 [Mauritius].
Isocardia (*Meiocardia*) *moltkiana* – ROEMER, 1869: 8-9, pl. 1, figs 4-7 [Australia to Philippines]. — PRASHAD, 1932: 149-150 [pars] [Indonesia].
Isocardia (*Meiocardia*) *Moltkeana* var. *lamarcki* – LAMY, 1920: 298-300 [Mauritius].
Isicardia (*sic*) (*Meiocardia*) *moltkiana* – ABRARD, 1947: 39, pl. 3, fig. 11 [Miocene, New Hebrides].
Meiocardia moltkiana sanguinomaculata (*sic*) – KIRA, 1959: 194, pl. 71, fig. 5 [Japan]. — SHIKAMA, 1964: 67, pl. 41, fig. 13 [Mie Pref., central Japan].
Meiocardia moltkiana – KURODA et al., 1971: 673 (Japanese), 440 (English), pl. 97, figs 11-12 [Sagami Bay, central Japan]. — ORUTANI & MATSUKUMA, 1982: 175-176, pl. 10, fig. 5 [Izu Peninsula, central Japan]. — MATSUKUMA, 1986: 324-325 (f.) [Okinawa]. — KOSUGE & KASE, 1994: pl. 10, fig. 10 [Spengler's type material].
Meiocardia tetragona – DRIVAS & JAY, 1988: 142, pl. 56, fig. 5 [Réunion & Mauritius].
Meiocardia lantarckii – KOSUGE & KASE, 1994: pl. 10, fig. 12 [one of the syntypes].

TYPE MATERIAL. — "Die Moltkische *Chama*": Spengler's illustrated specimens are stored in Zoologisk Museum, Copenhagen (not examined). — *Meiocardia lamarckii*: syntypes, Reeve collection, BMNH. — *Meiocardia nishimurai*: holotype, a conjoined specimen IMT-94-1.

TYPE LOCALITY. — "Die Moltkische *Chama*": South seas [tropical Indo-West Pacific]. — *Meiocardia lamarckii*: China. — *Meiocardia nishimurai*: Ogasawara Islands, Japan.

MATERIAL EXAMINED. — Pleistocene: **Japan**. Ryukyu Limestone, Kikaijima Is., Kagoshima Pref. (NSMT-Mo69745).
Recent: **Japan**. Kameki-sho reef, Sagami Bay (NSMT-Mo43435). — 1.5 km SW of Jogashima, Sagami Bay, 70-75 m (NSMT-Mo69739). — Futami Bay, Chichijima Island, Bonin Islands, 27°04.5′ N, 142°07.1′ E, 115 m (NSMT-Mo59790). — Bonin Islands, holotype of *Meiocardia nishimurai* (IMT-

Source : MNHN, Paris



FIGS 2-6. — Dentition and gross anatomy of *Meiocardia*. — **2a-b**, *Meiocardia samarangiae*. — **3a-b** & **4a-b**, *Meiocardia moltkiana*. — **5a-b**, *Meiocardia sanguineomaculata*. — **6a-b**, *Meiocardia hawaiana*. 1, 3a-3b, cardinals in the right valve. 2a-2b & 4b, cardinals in the left valve. LAI & LAIII: Anterior laterals in the right valve. LAII: Anterior lateral in the left valve. LPI & LPIII: Posterior laterals in the right valve. LPII: Posterior lateral in the left valve. **aa**: Anterior adductor. **al**: Adult ligament. **es**: Exhalant siphon. **f**: Foot. **id**: Inner demibranch. **is**: Inhalant siphon. **od**: Outer demibranch. **pa**: Posterior adductor. s: Siphons.

Source : MNHN, Paris

94-1). — Aichi Pref. (NSMT-Mo69740, Kawamura Coll.). — Off Kirimezaki, Wakayama Pref. (NSMT-Mo69741). — Wakayama Pref., 54 m (ANSP 274370). — Tokushima Pref. (NSMT-Mo69742, Kawamura Coll.). — Okinoshima Island, Kochi Pref. (NSMT-Mo42307). — Kochi Pref. (NSMT-Mo69743, Kawamura Coll.). — Nishinohama, Tomioka, Kumamoto Pref. (NSMT-Mo43455). — 20-40 m, Tomioka Bay, Kumamoto Pref. (LACM 82-23). — Tomioka Bay (NSMT-Mo43436). — Okinawa Pref. (NSMT-Mo63233). — 60 m, 1 km WNW of Onna-son, Okinawa Pref. (LACM 79-76, 78-101).
China. (ZMA). — (ANSP 54195, 189703, 217140). — (BMNH reg. no. 1907.12.30.505; Reeve coll.; Cuming coll.; Winckworth coll.; Trochman coll.).
Philippines. (NSMT-Mo69744, Kawamura Coll.). — Luzon Island (BMNH).
MUSORSTOM 1: stn 57, 13°53′ N, 120°13.5′ E, N of Lubang Is., 96-107 m.
MUSORSTOM 2: stn CP 21, 14°00′ N, 120°17′ E, N of Lubang Is., 191-192 m (all MNHN).
Indonesia. Off Maroepi Is., Ambai Group, Japen Is., Geelvink Bay, 36-45 m, mud and shells (ANSP 279722). — 1.6 km NE of Roemwakon, Aoeri Is., Geelvink Bay, 36-45 m (ANSP 205650, 275802). — 3.6 km N of Matas, Aoeri Is., Geelvink Bay, 32-36 m (ANSP 208922).
Coral Sea. CHALCAL 1: stn CP 7, 19°18′ S, 158°36′ E, Plateau Chesterfield-Bellona, 65-68 m (MNHN).
New Caledonia. LAGON: stn 836, Secteur de Poindimié, 20°46′ S, 165°16′ E, 57 m, a conjoined specimen. — Stn 928, Secteur de Koumac, 20°45′ S, 164°23′ E, 7-10 m, a conjoined specimen. — Stn 983, Secteur de Poum, 20°23′ S, 163°57′ E, 38-68 m (MNHN).
"Vauban" 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m (MNHN).
SMIB 5: stn DW 81, 22°38′ S, 167°35′ E, 110 m (MNHN).
Thailand. Phuket (NSMT-Mo43437).

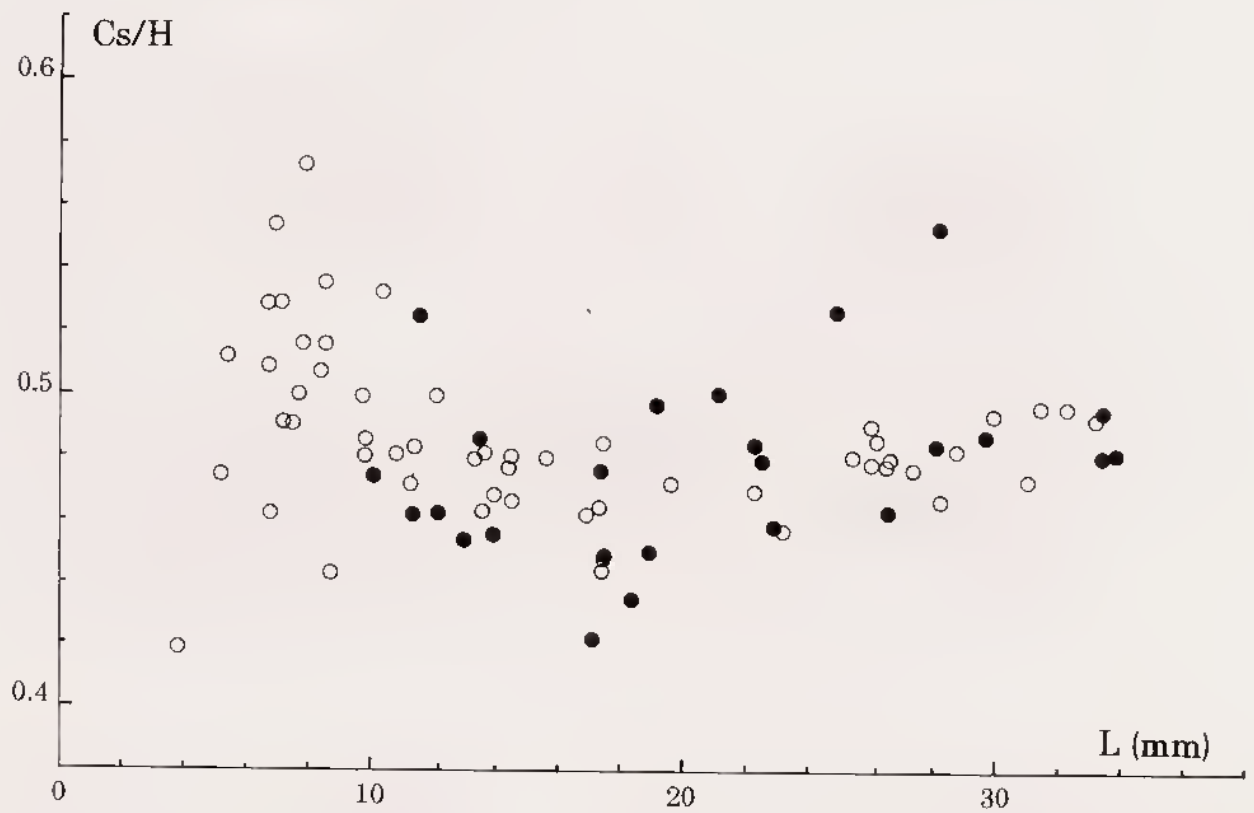


FIG. 7. — Scatter diagram showing relationship between L and Cs/H in *Meiocardia moltkiana*. Dots: Specimens from Japan and China. N = 25; r = 0.325; regression equation Cs/H = 0.00129L + 0.451. Circles: Specimens from Réunion. N = 55; r = -0.258; regression equation Cs/H = -0.000818L + 0.500.

Source : MNHN, Paris

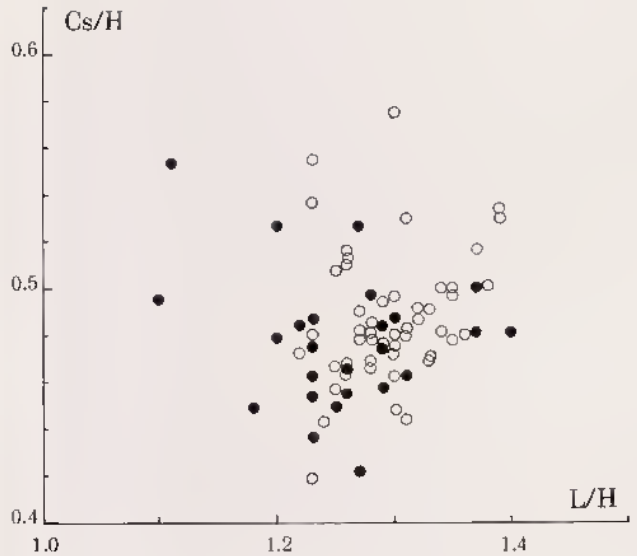


FIG. 8. — Scatter diagram showing relationship between Cs/H and L/H in *Meiocardia moltkiana*. Dots: Specimens from Japan and China. N = 25; r = ·0.210; regression equation Cs/H = -0.0874L/H + 0.587. Circles: Specimens from Réunion. N = 55; r = 0.207; regression equation Cs/H = 0.132L/H + 0.316.

Andaman Sea. Port Blair, Andaman Island (BMNH). — 19.2 km NW of Port Blair, 11°49′ N, 92°53′ E, 90 m, shelly sand (ANSP 292189). — Maldives, NW of Maduwari Is., Fadiffolu Atoll, ca. 5°18′ N, 73°29′ E. 45-63 m (ANSP 325451).
Seychelles. Saya de Mala Bank, 100 m (BMNH).
Malagasy. Tuléar (MNHN); 7.2 km W of Nosy N'Tangan, SW Nossi Bé (ANSP 260078).
Réunion. MD 32 Réunion: stn DC 41, 21°21′ S, 55°27′ E. 75 m. — Stn CP 42, 21°21′ S, 55°27′ E, 74-77 m. — Stn DC 43, 21°21′ S, 55°27′ E, 73-77 m. — Stn DR 47, 21°23′ S, 55°37′ E, 205-215 m. — Stn DC 54, 21°06′ S, 55°13′ E, 80-83 m. — Stn CP 55, 21°05′ S. 55°13′ E, 97-110 m. — Stn DC 56, 21°05′ S, 55°12′ E, 170-225 m. — Stn DC 85, 21°00′ S. 55°15′ E, 58-70 m. — Stn DC 124, 20°52′ S. 55°37′ E, 40 m. — Stn DC 126, 20°52′ S, 55°38′ E. 110 m. — Stn CP 129. 20°51′ S. 55°36′ E. 290-300 m. — Stn DC 176, 21°02′ S, 55°11′ E, 165-195 m (all MNHN).

DISTRIBUTION. — Miocene: New Hebrides [Vanuatu] (ABRARD, 1947). Pleistocene: Japan.
Recent: Western Japan, China, Philippines, Coral Sea. New Caledonia, Thailand, Seychelles, Malagasy, Réunion, Mauritius.

This species lives in coarse sediments in shallow water, approximately 7-70 m, but empty shells have been collected from deeper than 300 m.

DESCRIPTION. — *Shell* small, thick, subcircular, strongly inequilateral, equivalve. Mean of L/H in Japanese and Chinese specimens 1.257 (N = 25, SD = 0.070), not significantly correlated with L (r = 0.158, a = 0.05); mean of L/H in Réunion 1.297 (N = 55, SD = 0.043), not significantly correlated with L (r = -0.0418, a = 0.05). Mean of Cs/H in Japanese and Chinese specimens 0.478 (N = 25, SD = 0.029), not significantly correlated with L (r = 0.325, a = 0.05); mean of Cs/H in Réunion 0.487 (N = 55, SD = 0.027), not significantly correlated with L (r = ·0.258, a = 0.05) (Fig. 7); L/H not significantly correlated with Cs/H in both areas (r = -0.210 in Japan and China, r = 0.207 in Réunion, a = 0.05) (Fig. 8).

Beak prosogyrate, spirally twisted. Strong keel from beak to postero-ventral margin. Postero-ventral margin pointed, protruding, with a sinuation just anterior to smooth keel. Outer surface yellowish white, ornamented with regularly spaced concentric ribs on anterior and central slopes. Posterior slope widely concave, smooth except fine growth striae. Inner surface creamy or milky white, shining. Anterior adductor scar semicircular; posterior adductor scar subcircular; both scars nearly equal in size.

Measurements. See APPENDIX, Table 1.

REMARKS. — SPENGLER (1783) fully described the species, but did not give it a Latin name. Although the name, "die Moltkische *Chama*" of SPENGLER (1783), was latinized by CHEMNITZ (1784).

Source : MNHN, Paris

the work of MARTINI & CHEMNITZ (1769-1795) was placed by the Commission of Zoological Nomenclature on the List of Invalid Works, so Gmelin (1791) must be accepted as the author of the species.

Although PRASHAD (1932) cited figures given by REEVE (1845: pl. 1, fig. 1), ADAMS & REEVE (1850: 77, pl. 22, fig. 3) and BUELOW (1906: 37-38, pl. 8, fig. 7) as *Meiocardia moltkiana*, the shells illustrated by REEVE (1845) and others represent *Meiocardia sanguineomaculata*, which has a smaller, rounded shell with much coarser ribs and has conspicuous nodules on the primary keel.
Although KEEN & CASEY (1969) assigned the specimen figured by CHENU (1862: 113, fig. 533) to *Meiocardia moltkiana*, it has an antero-posteriorly elongated shell with a smooth and gently rounded postero-dorsal area. The outer surface of shell is ornamented with fine concentric ribs and lacks nodules on the postero-dorsal keel. LAMY (1920) correctly pointed out that this is not *M. moltkiana*, but *M. vulgaris* (Reeve, 1845).

Juveniles of *M. moltkiana*, which have thin, quadrate shells, are similar to *Meiocardia hawaiana*, but they differ from the latter in having stronger ribs and a straight cardinal (2a).

Shells from Bonin Islands (NSMT-Mo59790 and IMT-94-1) have a somewhat distinct sulcation in front of a strong primary keel and reddish brown brotches. Although KOSUGE & KASE (1994) proposed for it the name *Meiocardia nishimurai*, Holocene shells from Kikaijima Island, Kagoshima Prefecture, present intermediate characters between the Bonin Island form and others. We prefer to treat *M. nishimurai* as a synonym of *M. moltkiana* till additional material is collected.

Although MATSUKUMA (1992) considered that *Meiocardia moltkiana* differs from *Meiocardia lamarckii* in having higher, thinner shells, with a weaker primary keel, a series of specimens from Réunion shows continuous variation between the two forms (Figs 25, 26a-d).

Meiocardia sanguineomaculata (Dunker, 1882)

Figs 5, 22-23

Isocardia moltkiana var. *sanguineomaculata* Dunker, 1882: 213 ["Korea"].

Other references:

Isocardia moltkiana – REEVE, 1845: *Isocardia* sp. 1, pl. 1, fig. 1 [Luzon, Philippines]. — ADAMS & REEVE, 1850: 77, pl. 22, fig. 3 ["Korea"]. — BUELOW, 1906: 37-38, pl. 8, fig. 7.
Isocardia (*Meiocardia*) *moltkeana* var. *sanguineomaculata* – LAMY, 1920: 298-299.

TYPE MATERIAL. — DUNKER based the name *sanguineomaculata* on the shell illustrated by ADAMS & REEVE (1850). This specimen was not found in BMNH.

TYPE LOCALITY. — Although ADAMS & REEVE (1850) noted the locality of their shell is "Corea" [= Korea], no additional specimens of this species have been rediscovered since their report. We think the shell came from tropical Indo-West Pacific, most probably from the Philippines.

MATERIAL EXAMINED. — Recent: **Philippines**. Luzon Island (BMNH 1989179). *"Albatross"*: stn 5136, off Jolo, Jolo Is., 40 m, sand with shells (USNM 294545). — Stn D 5138, off Jolo, Jolo Is., 34 m, sand and coral (USNM 431190). — Stn 5139, off Jolo, Jolo Is., 36 m, coarse sand (USNM 294513). — Stn 5146, off Sulade Is., Sulu Archipelago, 43 m, coarse sand with shells (USNM 292393). — Stn 5148, off Sirun Is., Sulu Archipelago, 31 m, coarse sand (USNM 235929). — Stn 5149, W of Lapac, Tapul Is., 18 m, coarse sand with shells (USNM 235950). — Stn 5151, off Sirun Is., Tawitawi Is., Sulu Archipelago, 43 m, coarse sand with shells (USNM 292027). — Stn 5253, Pakiputan Strait, Mindanao, 50 m (USNM 237240).
Andaman Sea. Port Blair, Andaman Is. (BMNH 1989178).
Seychelles. REVES 2: stn 10, 05°02′ S, 55°44′ E, 45 m, a conjoined specimen. — Stn 16, 05°36′ S, 56°56′ E, 55 m, a conjoined specimen. — Stn 18, 05°45′ S, 56°35′ E, 50 m. — Stn 24, 05°09′ S, 55°25′ E, 35 m, a conjoined specimen. — Stn 30, 04°42′ S, 54°24′ E, 47 m, a conjoined specimen (all MNHN).

Source : MNHN, Paris

Farquar Group, 9°41′ S, 51°03′ E, 16 Dec. 1964 (USNM 718999).
Saya de Malha Bank, Indian Ocean, 99 m, 2 conjoined specimens (BMNH 1910.8.31.688-689, J.S. Gardiner Coll.)

DISTRIBUTION. — Recent: Philippines, Andaman Islands, Seychelles. *Meiocardia sanguineomaculata* is a species of coarse sediments in 10 to 100 m.

DESCRIPTION. — *Shell* small, thick and solid, subquadrate, strongly inflated, strongly inequilateral, equivalve. Mean of L/H 1.145 (N = 28, SD = 0.073), not significantly correlated with L (r = 0.159, a = 0.05). Mean of Cs/H 0.515 (N = 28, SD = 0.034), not significantly correlated with L (r = 0.155, a = 0.05) (Fig. 9). L/H significantly correlated with Cs/H (r = 0.519, a = 0.05) (Fig. 10). Outer surface ornamented with strong concentric ribs. The primary keel with prominent tubercles, wide, rounded. Postero-ventral margin with prominent sulcation just in front of the roundly protruded primary keel. Outer coloration whitish yellow with reddish brown triangular blotches. Beaks spirally enrolled. Inner surface creamy white, pale brown posteriorly. Anterior adductor scar elongated oval to semicircular; posterior adductor scar subcircular; both scars nearly equal in size.

Measurements. See APPENDIX, Table 2.

REMARKS. — *M. sanguineomaculata* has a thick, globular shell with Cs/H often exceeding 0.5 and L/H around 1.1. The shell form suggests that this species is most probably an inactive shallow burrower. This species differs from *Meiocardia moltkiana* by having an antero-posteriorly shortened, rounded shell with stronger concentric ribs and a distinct sinuation just anterior to the keel which has prominent tubercles.

Meiocardia vulgaris (Reeve, 1845)

Figs 12, 31-32

Isocardia vulgaris Reeve, 1845: *Isocardia* sp. 2, pl. 1, figs 2a-b [China].

Synonym:

Meiocardia delicata Kosuge & Kase, 1994: 29-30, pl. 11, figs 6-8, pl. 12, figs 1-3 [Okinawa, Japan]. **(Syn. nov.)**.

Other references:

Isocardia moltkiana – SOWERBY, 1852: 82, pl. 6, fig. 126. — CHENU, 1862: 113, fig. 533. - - ABBOTT & DANCE, 1982: 351, f.
Isocardia (*Meiocardia*) *vulgaris* – ROEMER, 1868: 9-10, pl. 1, figs 9-10 [China]. — PRASHAD, 1932: 150-151 [Indonesia].
Isocardia vulgaris – BUELOW, 1906: 37-38, pl. 8, fig. 5 [China].
Isocardia (*Meiocardia*) *moltkeana* var. *vulgaris* – LAMY, 1920: 297-298 [China, Poulo-Condor, India].
Meiocardia vulgaris – SHIKAMA, 1964: 67, pl. 41, fig. 14 [East China Sea]. — KOSUGE & KASE, 1994: pl. 10, fig. 11 [one of syntypes; China].
Glossus (*Meiocardia*) *moltkiana* – KEEN & CASEY, 1969: N657, fig. E134-7 [= CHENU, 1862, fig. 533].

TYPE MATERIAL. — *Isocardia vulgaris*: 5 syntypes in BMNH, without registration number. — *Meiocardia delicata*: holotype, a conjoined specimen IMT-94-2.

TYPE LOCALITY. — *Isocardia vulgaris*: China. — *Meiocardia delicata*: Okinawa, Japan.

MATERIAL EXAMINED. — Recent: **Japan**. Holotype of *Meiocardia delicata* (IMT-94-2).
China. 5 syntypes of *Isocardia vulgaris* (BMNH). — R. Winckworth Coll. (BMNH). — L. A. Reeve Coll. (BMNH). — (ZMA). — (ANSP 54063, 54064, 138495). — (USNM 17495, 32049 and 75912). — (LACM 13513, 48064, A1463, A5076). — Hong Kong (USNM 47939). — Taiwan (KPM 761-2357). — China Sea (USNM 186123).
Philippines. "Philippines" (NSMT-Mo69747, Kawamura Coll.). — "Philippines", sandy mud, 9 m, H. Cuming coll. (BMNH). — Nazasa Bay, Zambales Prov., W Luzon, 14°48.9′ N, 120°05.5′ E, 29 m (LACM 60-40). — NE Villa Carmen, Bataan Prov., W Luzon, 2-9 m (LACM 89954). — W of Boan Is., Turtle Is, SW Sulu Sea, 29-32 m (LACM 89904).
"*Albatross*" stn 5097, S of Corregidor Is., Manila Bay, 54 m, gray mud, sand and shells (USNM 283971). — Stn 5107, off Corregidor Is., Manila Bay, 50 m, gray mud (USNM 235242). — Stn 5131,

Source : MNHN, Paris

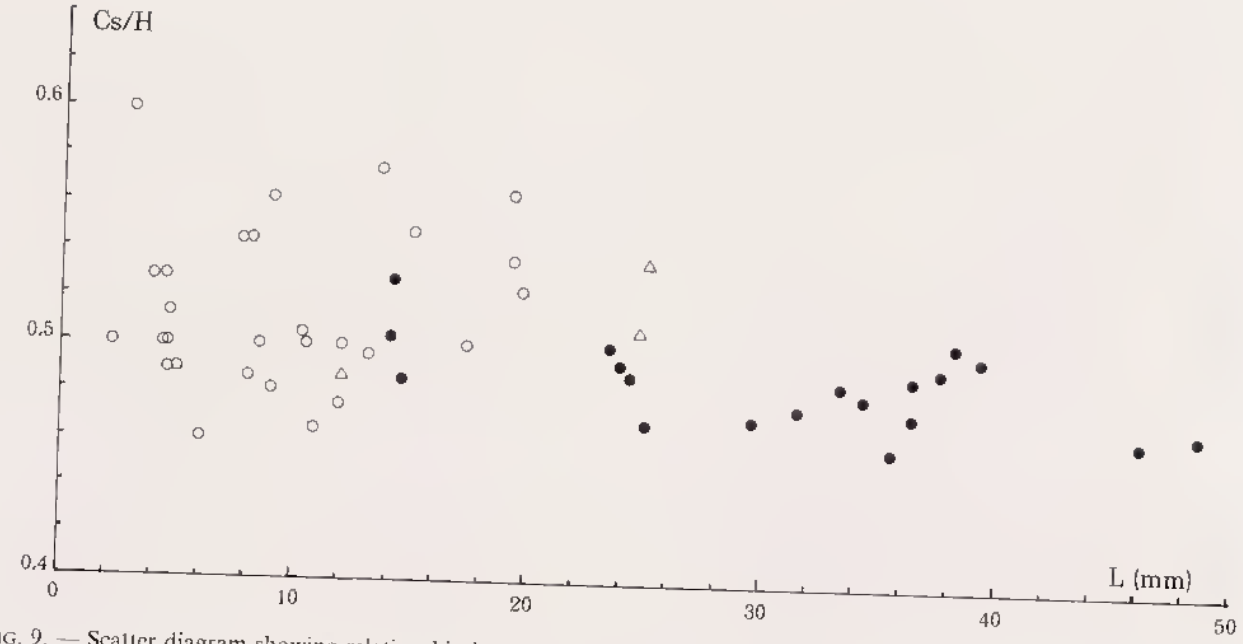


FIG. 9. — Scatter diagram showing relationship between L and Cs/H in *Meiocardia*. Dots: *Meiocardia vulgaris*. N = 19; r = -0.541; regression equation Cs/H = -0.000934L + 0.514. Circles: *Meiocardia sanguineomaculata*. N = 28; r = 0.155; regression equation Cs/H = 0.00103L + 0.505. Triangles: *Meiocardia globosa* sp. nov. N = 3.

off Panabutan Pt., W. Mindanao, 49 m, green mud and coarse sand (USNM 302604). — Stn 5156, off Tinakta Is., Tawitawi, SW Sulu Archipelago, 32 m, fine sand and shells (USNM 292117). — Stn 5157, off Tinakta Is., Tawitawi, SW Sulu Archipelago, 32 m, fine sand (USNM 236110). — Stn 5164, off SE Tawitawi, SW Sulu Archipelago, 32 m, green mud (USNM 283382). — Stn 5181, off Antonio Is., NE Panay, 47 m, fine muddy sand (USNM 248219, 293458). — Stn 5192, SE of Bantayan Is., NW of Cebu, 58 m, green sand (USNM 293088). — Stn 5210, N of Biliran Is., N of Leyte, 90 m, muddy sand (USNM 248221). — Stn 5220, N of Marinduque, 90 m, soft green mud (USNM 248376). — Stn 5235, off Magabao Is., E. Mindanao, 79 m, soft mud (USNM 294836). — Stn 5335, Linapacan Str., N of Palawan, 83 m, sandy mud (USNM 229229). — Stn 5336, Linapacan Str., off Observatory Is., N of Palawan, 83 m, sandy mud (USNM 297197). — Stn 5338, Palawan Pass, off Preservatory Is., 77 m, coarse sand and mud (USNM 237803, 297338). — Stn 5477, off Tacbac Pt., Leyte, 86 m, gray mud (USNM 238563). — Stn 5478, off Tacbac Pt., Leyte, 103 m (USNM 301132). — Stn 5480, off Tacbac Pt., Leyte, 112 m, fine sand (USNM 238581). E end of Corregidor Is., Manila Bay, 11-18 m (ANSP 247061). — SW of San Nicholas Shoals Light, Manila Bay (ANSP 246662, 246705). — Ragay Gulf, SE Luzon, 54 m (LACM 89903). — Ragay Gulf, SE Luzon (NSMT-Mo69746, Kawamura Coll.). — Hulagaan Is., Occidental Mindoro (ANSP 302071). — Borongan, Samar Prov.(LACM 89907). — Maqueda Bay, Samar Is. (MCZ). — N end of Cebu Is. (ANSP 245942). — Cebu (NSMT-Mo54938, 60557).

MUSORSTOM 3: stn DR 140, 11°43′ N, 122°34′ E, west of Panay Is., 93-99 m (MNHN). — Stn CP 141, 11°45′ N, 122°45′ E, west of Panay Is., 40-44 m (MNHN).

Malaysia. *"Albatross"*: stn 5358, off Sandakan, north Borneo, 70 m, mud (USNM 297635).

Indonesia. CORINDON: stn CH 205, 1°08′ S, 117°19′ E, Makassar Strait, 49 m, a conjoined specimen (MNHN).

Welkmost Bay, Bantam, Java (USNM 261137). — Tjiganter, Bantam, Java (USNM 261138). — 3°54′ S, 134°04′ E, W of Babi Is., Wokam, NE Aru, 54-63 m, mud (USNM 747420).

Source : MNHN, Paris

Australia. (USNM 95524, Jeffrey coll.); 14.4 km SE of Double Is., Tin Can Bay, Queensland (USNM 681655). — Bundaberg, Queensland, 45 m (LACM 30008).
Andaman Sea. 08°29′ N, 97°59′ E, 40 km NNW of Phuket, Thailand, 42 m, sandy mud (ANSP 291729). — 4.8 km NE of Lighthouse Is., Phuket, 144 m (ANSP 286326). — 13°00′ N, 97°41′ E, 56 km W of Tavoy Is., Andaman Is., 68 m, mud with shells (ANSP 292935). — 13°28′ N, 97°19′ E, 91.2 km NW of Tavoy Is., 39 m, shelly sand (ANSP 293036). — 12°03′ N, 92°57′ E, 40 km NNW of Port Blair, Diligent Strait, Andaman Is. 38 m, shelly sand (ANSP 292612).
Bay of Bengal. 15°08′ N, 94°04′ E, 80 km SW of Irrawaddy River, Preparis North Channel, Burma, 53 m, gray mud (ANSP 293697). — 19°32′ N, 92°52′ E, 27.2 km SSE of Akyab, Burma, 55 m, muddy sand (ANSP 294080). — 17°35′ N, 83°25′ E, 28.8 km SW of Vizagapatnam, NE India, 79 m, shelly sand (ANSP 294702). — 17°35′ N, 83°25′ E, 16 km SE of Vizagapatnam, NE India, 58 m, shelly sand (ANSP 294183).
Oman. 25°50′ N, 58°08′ E, Oman Gulf (USNM 716879).
Zanzibar. 3.2 km W of Chango Is., 27 m, shelly sand (ANSP 214511).
Malagasy. 96 km NE of Cape St. André (USNM 719126).

DISTRIBUTION. — Recent: China, Taiwan, Philippines, Malaysia, Indonesia, Queensland, Andaman Is., Burma, NE India, Oman, Zanzibar; Malagasy. This species lives in mud in 2 to 50 m, and empty shells have been collected in approximately 110 m on a mud bottom with shells.

DESCRIPTION. — *Shell* large for genus, occasionally attaining 45 mm in length, yellowish white. L/H significantly correlated with L (N = 19, r = 0.900, α = 0.05). Cs/H significantly correlated with L (N = 19, r = -0.541, α = 0.05) (Fig. 9). L/H significantly correlated with Cs/H (N = 19, r = -0.449, α = 0.05) (Fig. 15). Keel running from beak to postero-ventral corner not prominent. Postero-dorsal area smooth. Antero-ventral area ornamented with weak concentric ribs. Postero-dorsal margin rounded. Inner surface creamy white, umbonally yellowish, shining. Anterior adductor scar semicircular; posterior adductor scar subcircular; both scars nearly equal in size.

Measurements. See APPENDIX, Table 3.

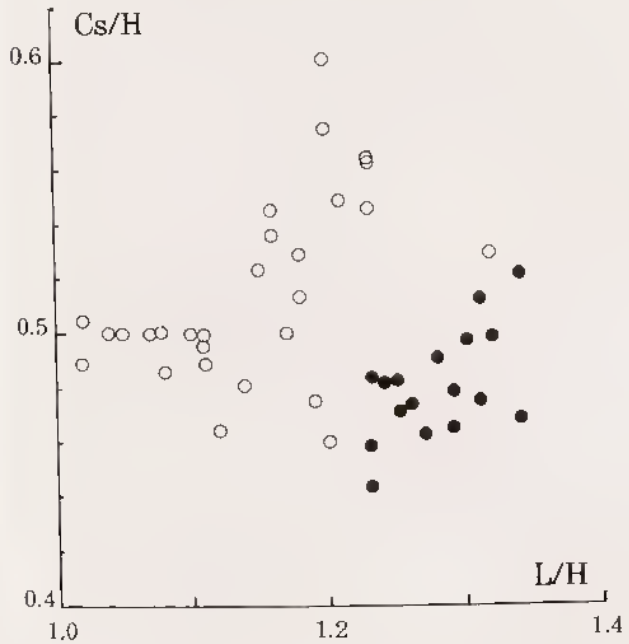
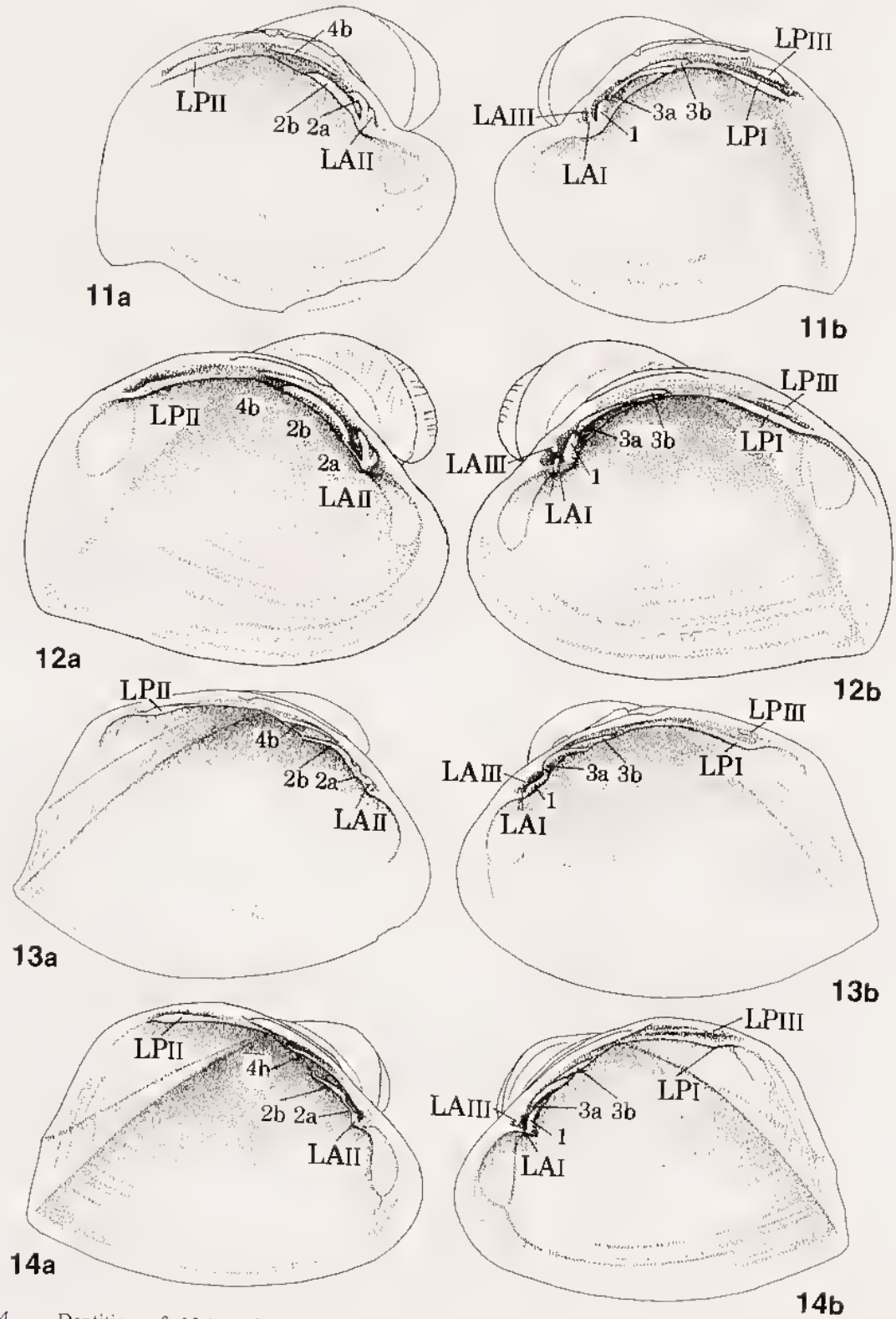


FIG. 10. — Scatter diagram showing relationship between L/H and Cs/H in *Meiocardia*. Dots: *Meiocardia hawaiana*. N = 17; r = 0.557; regression equation Cs/H = 0.287L/H + 0.113. Circles: *Meiocardia sanguineomaculata*, N = 28; r = 0.519; regression equation Cs/H = 0.245L/H + 0.234.

REMARKS. — This is the largest species in the genus and differs from *M. moltkiana* in having a gently protruded postero-dorsal margin, weaker commarginal ribs, and a smooth primary keel.

Although KOSUGE & KASE (1994) noted that *Meiocardia delicata* differs from *M. vulgaris* in having weaker comarginal sculptures and less globular shells, a gently arched postero-dorsal margin with delicate ornamentations is a characteristic of *M. vulgaris*.

Source : MNHN, Paris



FIGS 11-14. — Dentition of *Meiocardia* and *Glossocardia*. For the abbreviations see the explanation of Figs 2-6. — **11a-b**, *Meiocardia globosa* sp. nov. — **12a-b**, *Meiocardia vulgaris*. — **13a-b**, *Glossocardia agassizii*. — **14a-b**, *Glossocardia stoliczkana*.

Source : MNHN, Paris

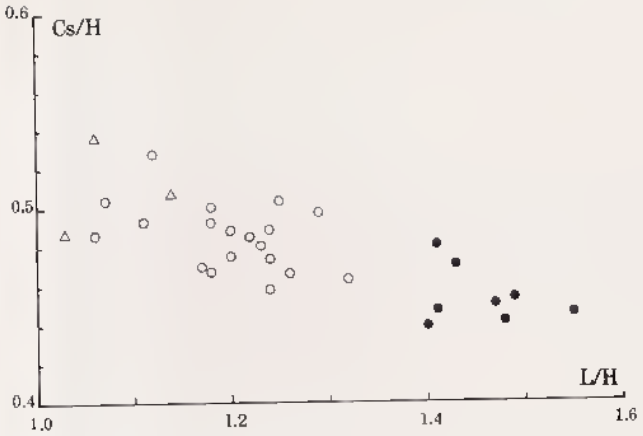


FIG. 15. — Scatter diagram showing relationship between L/H and Cs/H in *Meiocardia*. Dots: *Meiocardia samarangiae*. N= 8; r = 0.701; regression equation Cs/H = 0.00380L/H + 0.347. Circles: *Meiocardia vulgaris*. N = 19; r = -0.541; regression equation Cs/H = -0.000934L/H + 0.514. Triangles: *Meiocardia globosa* sp. nov. N = 3.

Meiocardia globosa sp. nov.

Figs 11, 30

TYPE MATERIAL. — Holotype: a conjoined specimen, NSMT-Mo69749. Paratypes: 1 conjoined specimen NSMT-Mo69750, 1 left valve NSMT-Mo69751; USNM 236796, 283380a.

TYPE LOCALITY. — Pescadores, Taiwan, coll. by K. Nakayasu.

MATERIAL EXAMINED. — Holotype. — *"Albatross"*, stn 5181, E of Gigante Is., Philippines, 47 m, mud and fine sand. — *"Albatross"*, stn 5164, SE of Tawitawi Is., Sulu Archipelago, Philippines, 32 m. — Makham Bay, Phuket, Thailand.

DISTRIBUTION. — Recent: Taiwan, Philippines, Indian Ocean coast of Thailand. This species lives on muddy sand bottoms in 30 to 50 m.

DESCRIPTION. — *Shell* rounded, more or less thin, strongly inequilateral, equivalve with strongly enrolled beaks. Postero-dorsal margin gently rounded. Outer surface ornamented with regularly spaced, strong, concentric ribs. Outer coloration yellowish brown. Primary keel sharp, smooth, without nodules, separating smooth postero-dorsal area. Postero-ventral margin with prominent sulcation just in front of the pointed primary keel. Inner surface milky white, umbonally yellowish. Anterior adductor scar semicircular; posterior adductor scar subcircular; both scars nearly equal in size.

Measurements (mm):

	V	L	H	L/H	Cb	Cs	Cs/H
NSMT-Mo69749 (holotype)	rv + lv	24.8	21.8	1.14	22.1	-	(0.507)*
NSMT-Mo69750 (paratype)	rv + lv	12.1	11.7	1.03	11.4	-	(0.487)
NSMT-Mo69751 (paratype)	lv	25.1	23.7	1.06	-	12.7	0.536

*Numericals in parentheses show Cb/2H, instead of Cs/H.

REMARKS. — *Meiocardia globosa* is closest to *M. vulgaris* which is sympatric. *Meiocardia globosa* has a more rounded, antero-posteriorly shorter shell, with stronger commarginal ribs and a more prominent keel (Figs 30a-d).

Source : MNHN, Paris

Meiocardia samarangiae Bernard, Cai & Morton, 1993

Figs 2, 16, 29

Meiocardia samarangiae Bernard, Cai & Morton, 1993: 67.

Synonym:

Isocardia tetragona Adams & Reeve, 1850: 76, pl. 22, fig. 1 [Japan; preoccupied by *I. tetragona* Koch & Dunker, 1837].

Other references:

Meiocardia tetragona – HIRASE, 1934: 17, 117, pl. 31, fig. 3 [Japan]. — HABE, 1951: 117, figs 243-245 [Japan]; 1958: 24-25, pl. 1, figs 5-6 [Japan]; 1977: 236, pl. 49, figs 8-9 [Japan and western Pacific]. — KIRA, 1959: 131, pl. 52, fig. 24 [Japan]; 1962: 148, pl. 53, fig. 24 [Japan]. — KURODA *et al.*, 1971: 614 (Jap.), 395 (Eng.), pl. 87, fig. 10 [Sagami Bay, Japan].

TYPE MATERIAL. — Supposed syntype: a conjoined specimen sticked on board, BMNH 1874.12.11.270.

TYPE LOCALITY. — Japan.

MATERIAL EXAMINED. — Pleistocene: **Japan**. Moeshima Shell Bed, Moeshima Is., Kagoshima Pref. (NSMT-Mo59576). — Ryukyu Limestone, Kamikatetsu, Kikaijima Is., Kagoshima Pref. (NSMT-Mo54638).
Recent: **Japan**. Jogashima, Miura Peninsula, Kanagawa Pref. (NSMT-Mo43441, 43442). — Hayama, Kanagawa Pref. (NSMT-Mo43444). — "Sagami Bay" (NSMT-Mo45452, 45468, 69753, 69754, Kawamura Coll.). — Amadaiba, Sagami Bay (NSMT-Mo43443). — Off Isshiki, Aichi Pref. (NSMT-Mo43450). — "Wakayama Pref." (NSMT-Mo4412). — Minabe, Wakayama Pref. (NSMT-Mo50907). — Off Sakaihama, Tanabe Bay, Wakayama Pref. (NSMT-Mo69752). — Tatsugahama, Wakayama Pref. (NSMT-Mo43454). — "*Soyo-Maru*" stn 345, 33°15'10" N, 134°12'00" E, off Cape Muroto, 199-165 m, gravel, pebbles mud, rock (NSMT-Mo43447). — Tosa Bay (NSMT-Mo43451, 43452, 53902, 69756). — Amachi (YC), Shimizu (IC, Aug. 1972), Kochi Pref. — Kuriya, Echizen-cho, Fukui Pref. (NSMT-Mo43453, 69755). — "*Soyo-Maru*" stn 483, 34°44'50" N, 130°47'10" E, Tsushima Strait, 130 m, sand (NSMT-Mo43440). — "*Soyo-Maru*" stn 468, 34°25'40" N, 129°47'00" E, Tsushima Strait, 112 m, mud sand (NSMT-Mo43448). — "*Soyo-Maru*" stn 301, 31°13'10" N, 131°26'10" E, off Satamisaki, 181 m, gravel, sand, shells (NSMT-Mo43445). — "*Soyo-Maru*" stn 417, 31°10'15" N, 130°26'00" E, off Kaimondake, 192 m, sand (NSMT-Mo43446). — East China Sea (NSMT-Mo43449). — Miyakojima Island, Okinawa Pref. (NSMT-Mo51917).

DISTRIBUTION. — Japan, China. This species lives in muddy sand in approximately 110 to 190 m.

DESCRIPTION. — *Shell* antero-posteriorly elongate, subquadrate, thin but robust, inflated, strongly inequilateral, equivalve. Mean of L/H 1.455 (N = 8, SD = 0.052), not significantly correlated with L (r = 0.0435, α = 0.05). Mean of Cs/H 0.453 (N = 8, SD = 0.015), not significantly correlated with L (r = 0.701, α = 0.05). L/H not significantly correlated with Cs/H (N = 9, r = 0.548, α = 0.05). Beaks low, prosogyrate. Primary keel running from beak to pointed postero-ventral margin. Secondary keel obscure. Outer surface with irregular commarginal ribs except on nearly smooth umbonal area. *Hinge* teeth thin; I long, parallel to dorsal margin; LPIII small. Inner surface creamy white. Anterior adductor scar semicircular; posterior adductor scar subcircular; both scars nearly equal in size.

Measurements (mm):

	V	L	H	L/H	Cb	Cs	Cs/H
NSMT-Mo 69752 (1)	rv + lv	29.9	20.1	1.49	18.2	-	(0.453)*
Mo 69752 (2)	rv + lv	29.7	21.1	1.41	20.3	-	(0.481)
Mo 69752 (3)	rv + lv	25.1	17.0	1.48	15.0	-	(0.441)
Mo 69752 (4)	rv + lv	20.0	15.4	1.30	(14.1)	-	-
NSMT-Mo 69753	rv + lv	28.0	18.1	1.55	16.1	-	(0.445)

Source : MNHN, Paris

	V	L	H	L/H	Cb	Cs	Cs/H
NSMT-Mo 69754 (1)	rv + lv	31.1	21.7	1.43	20.4	-	(0.470)
Mo 69754 (2)	rv + lv	29.5	20.9	1.41	18.7	-	(0.447)
NSMT-Mo 69755	rv + lv	27.7	18.9	1.47	17.0	-	(0.450)
NSMT (Tosa)	rv + lv	23.0	16.4	1.40	14.4	-	(0.439)

*Numericals in parentheses show Cb/2H, instead of Cs/H.

REMARKS. — *Isocardia tetragona* Adams & Reeve, 1850 is a primary junior homonym of *Isocardia tetragona* Koch & Dunker, 1837. *Meiocardia samarangiae* Bernard, Cai & Morton, 1993 is a replacement for ADAMS & REEVE's name. The scatter diagram of L/H — Cs/H shows that *M. samarangiae* clearly differs from any living species of *Meiocardia* (Figs 8, 10, 15).

Although BERNARD *et al.* (1993) recorded *M. samarangiae* from the Philippines to Japan, we think the species is restricted to seas around Japan. PRASHAD (1932) reported a *Meiocardia* species from Sulu Sea and Indonesia under the name *M. tetragona*. These specimens are an antero-posteriorly elongated form of *Meiocardia hawaiana*, because they have cardinals (1 and 2a) that are oblique to the dorsal margin (Fig. 35b).

Although HABE (1977) considered *Meiocardia hawaiana* to be a junior synonym of *M. tetragona*, the Hawaiian species differs from *M. tetragona* in having thinner, waxy white shells with oblique cardinals (1 and 2a).

The supposed life position of *M. samarangiae* which is suggested by attached animals, including bryozoans and sponges with siliceous spicules, is shown in Fig. 16. A specimen from Tosa Bay, Kochi Prefecture, has a muricid borehole at the ventral margin.

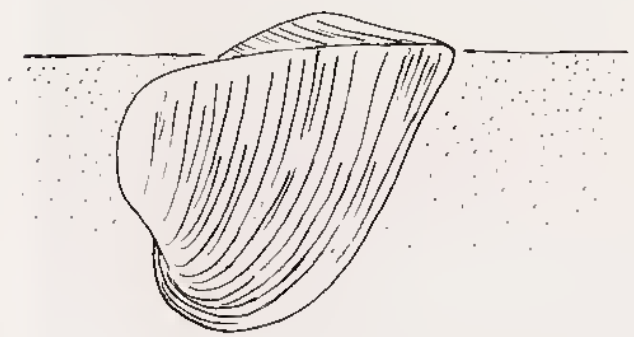


FIG. 16. — Supposed living position of *Meiocardia samarangiae*.

Meiocardia hawaiana Dall, Bartsch & Rehder, 1938

Figs 6, 33-37

Meiocardia hawaiana Dall, Bartsch & Rehder, 1938: 121-122, pl. 34, figs 17-18 [Hawaii].

Synonym?:

Bucardia (*Meiocardia*) *cumingii* Adams, 1864: 142.

Other references:

Isocardia (*Meiocardia*) *tetragona* — PRASHAD, 1932: 151-152, pl. 5, figs 3-4 [Sulu Archipelago].
Meiocardia lamarckii — HABE, 1951: 117 [western Japan]; 1977: 236 [western Japan]. — KIRA, 1959: 131, pl. 52, fig. 23 [Japan]. — MATSUKUMA, 1986: 324-325(f.) [Kochi Pref., western Japan].
Meiocardia hawaiana — WEAVER, 1963: 2, figs 1-2 [Oahu, Hawaii]. — KAY, 1979: 568, figs 184 A-B [Hawaii].

Source : MNHN, Paris

TYPE MATERIAL. — *Meiocardia hawaiana*: holotype, a right valve, USNM 173048 (BOSS, ROSEWATER & RUHOFF, 1968). Paratypes, USNM 338242, 338243, 346246, 428546.

TYPE LOCALITY. — *"Albatross"*, stn 4133, near Kauai, Hawaii, 74-562 m.

MATERIAL EXAMINED. — Recent: **Hawaii**. 21°02.1′ N, 156°47.25′ W, off Oahu, 220 m, a conjoined specimen (USNM 807654).
Japan. Off Isshiki, Aichi Pref. (NSMT-Mo43438). — Kumanonada Sea (YC). — Off Wakayama (1C). — Kochi Pref. (NSMT-Mo63224, Kawamura Coll.). — Tosa Bay off Kochi Pref. (NSMT-Mo43439, Kawamura Coll.). — Off Amitori, Iriomote Is., Okinawa Pref. (NSMT-Mo69757, 69758).
Philippines. *"Albatross"* stn 5173, off Jolo, Jolo Is., 335 m, shelly coarse sand (USNM 236529). — Stn 5212, off Sibugay Is., east of Masbate, 194 m, gray sand and mud (USNM 292687). — Stn 5268, off Matocot Point, west of Luzon, 306 m (USNM 295937).
MUSORSTOM 1: stn 19, 13°56′ N, 120°19′ E, north of Lubang Is., 167-187 m, a conjoined specimen (MNHN).
MUSORSTOM 2: stn 17, 14°00′ N, 120°17′ E, north of Lubang Is., 174-193 m. — Stn 19, 14°01′ N, 120°17′ E, north of Lubang Is., 189-192 m. — Stn DR 33, 13°32′ N, 121°07′ E, north of Mindoro Is., 130-137 m, a conjoined specimen and many empty shells. (all MNHN).
MUSORSTOM 3: stn CP 88, 14°01′ N, 120°17′ E, north of Lubang Is., 183-187 m. — Stn CP 98, 14°00′ N, 120°18′ E, north of Lubang Is., 194-205 m. — Stn DR 102, 14°01′ N, 120°18′ E, north of Lubang Is., 192 m. — Stn CP 108, 14°01′ N, 120°18′ E, north of Lubang Is., 188-195 m. — Stn DR 126, 11°49′ N, 121°22′ E, west of Panay Is., 266 m. — Stn CP 131, 11°37′ N, 121°43′ E, west of Panay Is., 120-122 m. — Stn CP 143, 11°29′ N, 124°11′ E, northwest of Leyte Is., 205-214 m, a conjoined specimen and several empty shells. (all MNHN).
"Siboga": stn 95, Sulu Archipelago, 2 conjoined specimens (ZMA). — Stn 105, Sulu Archipelago, 3 conjoined specimens (ZMA).
Indonesia. 6°07′ S, 133°57′ E, 12.8 km southwest of Tg Ratoe, Maikoor, Aru, Moluccas, 45 m, a conjoined specimen (USNM 755534). — 5°32′ S, 133°E, east side of Mitduan reef, west coast of Nuhu Tjut, Kai Is., 54-56 m, 1 conjoined specimen (USNM 747158). — *"Siboga"*: stn 66, south of Salayar, Sulawesi, 1 conjoined specimen (ZMA).
Chesterfield Islands. CHALCAL 1: stn D 63, Banc Nova, 22°11′ S, 159°15′ E, 305 m (MNHN).
MUSORSTOM 5: stn 270, 24°49′ S, 159°34′ E, Banc Capel, 223 m. — Stn 277, 24°11′ S, 159°35′ E, Banc Kelso, 270 m — Stn 285, 24°09′ S, 159°34′ E, Banc Kelso, 245-255 m. — Stn 309, 22°10′ S, 159°23′ E, Banc Nova, 340 m. — Stn 329, 20°23′ S, 158°47′ E, 320 m. — Stn 350, 19°34′ S, 158°35′ E, 280 m. — Stn 376, 19°51′ S, 158°30′ E, 280 m. — Stn 378, 19°54′ S, 158°38′ E, 355 m. — Stn 388, 20°45′ S, 160°54′ E, 500-510 m. (all MNHN).
New Caledonia. *"Vauban"* 1978-79: stn 3, S New Caledonia, 22°17′ S, 167°12′ E, 390 m (MNHN).
BIOCAL, stn DW 64, 24°48′ S, 168°09′ E, 250 m (MNHN).
BIOGEOCAL: stn KG 252b, 21°31′ S, 166°21′ E, 330 m. — Stn DW 253, 21°32′ S, 166°29′ E, Loyaute Bassin, 310-315 m (all MNHN).
CHALCAL 2: stn DW 71, 24°42′ S, 168°10′ E, 230 m, 1 conjoined specimen (MNHN).
SMIB 3: stn DW 9, 24°42′ S, 168°08′ E, 265 m, 1 conjoined specimen (MNHN).
SMIB 4: stn DW 44, S New Caledonia, 24°46′ S, 168°08′ E, 270-300 m. — Stn DW 47, S New Caledonia, 24°46′ S, 168°08′ E, 250-280 m (all MNHN).
Loyalty Islands. MUSORSTOM 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m. — Stn DW 406, 20°41′ S, 167°07′ E, 373 m. — Stn DW 407, 20°41′ S, 167°07′ E, 360 m, 1 conjoined specimen. — Stn DW 416, 20°42′ S, 167°00′ E, 343 m. (all MHNH).
SMIB 5: stn DW 88, 22°19′ S, 168°40′ E, Ride des Loyaute, 350 m, 2 conjoined specimens. — Stn DW 90, 22°19′ S, 168°42′ E, Ride des Loyaute, 340 m. — Stn DW 97, 23°01′ S, 168°18′ E, 300 m, 1 conjoined specimen. — Stn DW 98, 23°02′ S, 168°16′ E, 335 m. (all MNHN).
New Hebrides Arc. VOLSMAR: stn DW 7, 22°27′ S, 171°44′ E, Ride des Loyauté, 325-400 m. — Stn DW 17, 22°23′ S, 171°41′ E, 260-300 m, 1 conjoined specimen, 6 rv, 6 lv. — Stn DW 38, 22°22′ S,

Source : MNHN, Paris

168°44′ E, 380-420 m. — Stn DW 42, 22°17′ S, 168°42′ E, 340-400 m. (all MNHN).
Réunion. MD32 Réunion: stn CP 129, 20°51′ S, 55°36′ E, 290-300 m (MNHN).

DISTRIBUTION. — Hawaii, Japan, Philippines, Indonesia, Coral Sea, New Caledonia; Indian Ocean side of Thailand, Réunion. This species lives on sand and mud bottoms in 45 to 220 m, and empty shells are occasionally recorded from 500 m or deeper.

DESCRIPTION. — *Shell* small to medium for genus, thin, subquadrate, glossy white. Mean of L/H 1.279 (N = 17, SD = 0.038), not significantly correlated with L (r = 0.342, a = 0.05). Mean of Cs/H 0.480 (N = 17, SD = 0.019), not significantly correlated with L (r = 0.311, a = 0.05). L/H significantly correlated with Cs/H (N = 17, r = 0.557, a = 0.05) (Fig. 10). Outer surface around keel and postero-dorsal area occasionally yellowish or reddish brown. Sharp, angular, primary keel separating very smooth postero-dorsal area from antero-ventral area with irregular commarginal ribs. Anterior cardinal (1) oblique to dorsal margin; 2a dorsally deeply concave, oblique to dorsal margin. Inner surface creamy white, occassionally posteriorly pale brown, shining. Anterior adductor scar semicircular; posterior adductor scar subcircular; both scars nearly equal in size.

Measurements. See APPENDIX, Table 4.

REMARKS. — ADAMS (1864) described *Bucardia* (*Meiocardia*) *cumingii* on the basis of material from China. Although the species was said to have a waxy white shell, he only gave a brief description without any measurements. The type material was not found in BMNH during a visit by one of us (AM) in 1989. Instead of adopting a doubtful and obscure name for this species, we prefer to use *Meiocardia hawaiana*.

Family TRAPEZIDAE Lamy, 1920

DIAGNOSIS. — Shell trapezoidal, strongly inequilateral, equivalve, with prosogyrous beaks near anterior end. Ventral margin not gaping, smooth. Ligament external, opisthodetic, parivincular. Hinge with two lamellar cardinals and two laterals. Outer surface ornamented with commarginal and radial sculpture. Dimyarian, with subequal adductor muscles. Foot small, grooved, often byssate. Pallial line simple, without sinus.

Genus *GLOSSOCARDIA* Stoliczka, 1870

Type species: *Cypricardia obesa* Reeve, 1843.

DIAGNOSIS. — *Shell* subquadrate, thin in young, thick and solid in large specimens, yellowish. Beaks not prominent. Larval ligament anterior to beaks. Primary keel separating a flat posterior slope, sharp. Two additional keels on posterior slope, the secondary and tertiary keels weak but distinct; secondary keel, the weakest of the three, running from the beak to postero-dorsal corner, separating postero-dorsal margin. The stronger, tertiary keel located on the posterior slope near primary keel. Outer surface nearly smooth except for weak, irregular commarginal ribs and radial rows of microscopic scales. *Hinge* cyprinoid; teeth parallel to hinge margins; anterior cardinal in the right valve (1) lamellate in juvenile, nodulous in adult; posterior lateral in left valve (LPII) small, finely nodulated.

REMARKS. — Only three living species, *Glossocardia agassizii*, *G. obesa* and *G. stoliczkana*, belong to this genus. The Eocene *Meiocardia carolinae* Harris, 1919a, has a more or less prominent tertiary keel on the posterior slope near the primary keel (HARRIS, 1919b) and is safely placed in this genus. *Meiocardia suzukii* Squires & Advocate, 1986, from the Eocene Maniobra Formation of California, has shells that are not as inflated and lack strongly spirogyrate umbones. Although *M. suzukii* apparently lacks the tertiary keel on the posterior slope, it possibly belongs to *Glossocardia*.

Source : MNHN, Paris

Glossocardia obesa (Reeve, 1843)

Figs 18-19

Cypricardia obesa Reeve, 1843: *Cypricardia* sp. 10: pl. 2, fig. 10 [locality unknown].

Other references:

Glossocardia obesa — HABE, 1951: 118-119, figs 247-248 [Okinawa, Japan].
Trapezium (*Glossocardia*) *obesa* (*pars*) · SOLEM, 1955: 73-74, pl. 6, figs 11-12 (holotype).

TYPE MATERIAL. — Holotype, a conjoined specimen. BMNH 1952.10.10.7.8.

TYPE LOCALITY. — Not given.

MATERIAL EXAMINED. — Recent: **Indonesia**. Silale, Ambon (NSMT-Mo69759).
Philippines. Batangas Is., N of Cebu, coll. Poppe, 1 conjoined specimen (MNHN).
Chesterfield Islands. CORAIL 2: stn DW 71, 19°15′ S, 158°24′ E, 55 m, 1 conjoined specimen. — Stn DW 138, 19°34′ S, 158°18′ E, 31 m, 1 rv (all MNHN).
New Caledonia. LAGON: stn 612, 22°09′ S, 167°01′ E, 46-48 m, 1 rv (MNHN).

DISTRIBUTION. — Recent: Okinawa, Japan; Philippines; Ambon, Indonesia; New Caledonia; Chesterfield Islands.

DESCRIPTION. — *Shell* trapezoidal, thin in juveniles but thick and solid in full-grown specimens. Beaks prosogyrous, low, not strongly enrolled. Larval ligament small, anterior to beaks. Primary keel low, separating slightly concave postero-dorsal area. Outer surface ornamented with irregularly spaced commarginal lamellae with numerous microscopic scales. Postero-ventral corner bluntly pointed. Inner surface creamy white. Anterior adductor scar semicircular, thickened ventrally; posterior adductor scar subcircular; both scars nearly equal in size.

Measurements (mm):

	V	L	H	L/H	Cb	Cs	Cs/H
NSMT-Mo69759-1	rv + lv	31.5	20.5	1.53	16.4	-	(0.400)*
Mo69759-2	rv	61.6	43.3	1.42	-	21.2	0.490

*Numericals in parentheses show Cb/2H, instead of Cs/H.

REMARKS. — Young specimens of *Glossocardia obesa* are apparently very close to *Meiocardia* species in having a more or less translucent shell with the larval ligament anterior to the beaks and in having lamellar cardinals, but they clearly differ from *Meiocardia* in having microscopic scales on the outer surface.

Glossocardia stoliczkana (Prashad, 1932)

Figs 17, 20, 39

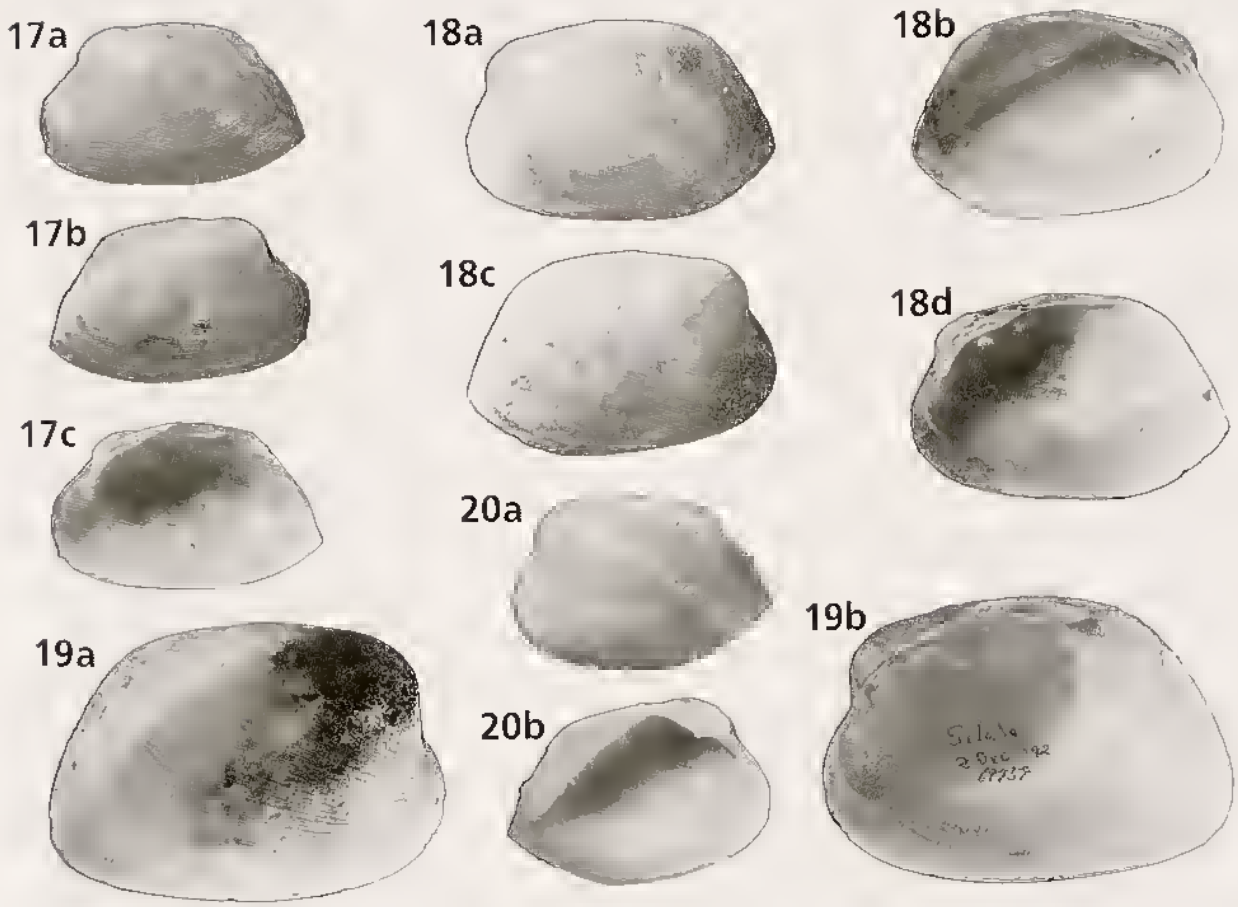
Glossocardia stoliczkana Prashad, 1932: 148-149, pl. 8, figs 15-18 [Sulu Archipelago, Philippines].

TYPE MATERIAL. — Holotype, a conjoined specimen, ZMA no registration number.

TYPE LOCALITY. — "*Siboga*", stn 97, 5°48.7′ N, 119°49.6′ E, Sulu Archipelago, Philippines, 564 m.

MATERIAL EXAMINED. — Pleistocene (?): Niue, a conjoined specimen, G. Paulay coll. (USNM).
Recent: **Philippines**. Sulu Archipelago (holotype, ZMA). — Mactan Island, Cebu, a conjoined specimen (NSMT-Mo57861).

Source : MNHN, Paris



FIGS 17-20. — Shells of *Glossocardia*. — **17a-c**. *Glossocardia stoliczkana*. Sulu Archipelago, Philippines (holotype, ZMA). Shell length 19.8 mm. — **18a-d**, *Glossocardia obesa*. Ambon, Indonesia (NSMT-Mo69759). Shell length 31.5 mm. — **19a-b**, *Glossocardia obesa*. Ambon, Indonesia (NSMT-Mo69759). Shell length 61.6 mm. — **20a-b**, *Glossocardia stoliczkana*. Loyalty Ridge, New Caledonia (MNHN). Shell length 19.3 mm.

MUSORSTOM 2: stn DR 33, 13°32′ N, 121°08′ E, north of Mindoro Is., 130-137 m, 1 rv (MNHN).
MUSORSTOM 3: stn DR 137, 12°03′ N, 122°06′ E, north of Panay Is., 56 m, 1 lv (MNHN).
Loyalty Islands. MUSORSTOM 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 1 rv. — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 1 rv. — Stn DW 418, 20°42′ S, 167°03′ E, 283 m, 1 rv. — Stn DW 439, 20°46′ S, 167°17′ E, 288 m, 1 rv. — Stn DW 440, 20°49′ S, 167°17′ E, 288 m, 1 lv. (all MNHN).

DISTRIBUTION. — Pleistocene: Niue. Recent: Cebu, Mindoro, Panay, Sulu Archipelago, Philippines; New Caledonia. This species is known from 56 to 564 m.

DESCRIPTION. *Shell* small, thin, inflated, high, quadrangular, strongly inequilateral, equivalve. Mean of L/H 1.399 (N = 8, SD = 0.132), not significantly correlated with L (r = -0.486, a = 0.05). Cs/H significantly correlated with L (r = 0.885, a = 0.05) (Fig. 21). L/H not significantly correlated with Cs/H (N = 8, r = -0.660, a = 0.05). Umbones prosogyrous, low, not prominent, translucent. Outer surface white, ornamented with weak commarginal ribs and radial rows of fine scales; posterior area orange, smooth, with two narrow radial riblets (Fig. 39b, s and t) and fine growth striae, concave, separated from middle area by a sharp keel. Postero-ventral margin pointed, without a sinuation like *M. sanguincomaculata*. Inner color white, orange posteriorly. *Hinge*-teeth thin; 1 thin and lamellar in young specimens, and solid, and rounded-lamellar in older specimens; 3a long, thin; 3b weakly bifid; LAI small; LAIII small but distinct; LPI long, strong; LPIII small, long and narrow; 2a small, thin; 2b rather long, thin; 4b long and narrow, thin; LAII very small, indistinct; semicircular, thickened ventrally; posterior adductor scar subcircular or ovate. Pallial scar entire, wide, integripalliate.

Source : MNHN, Paris

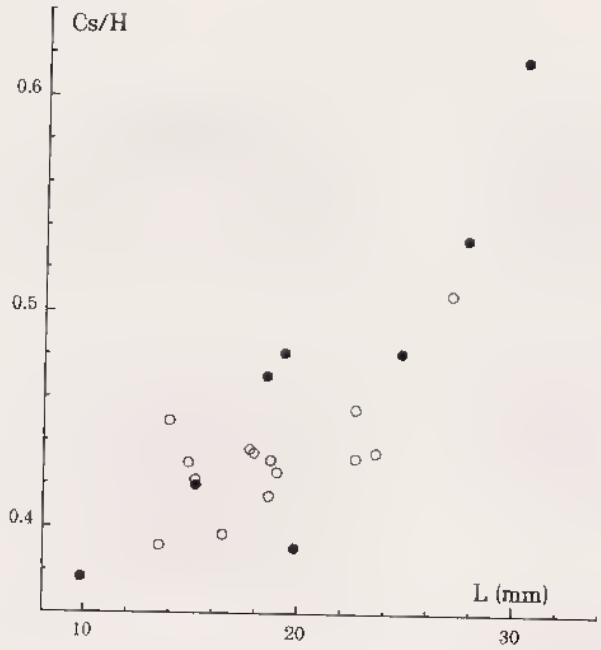


FIG. 21. — Scatter diagram showing relationship between L and Cs/H in *Glossocardia*. Dots: *Glossocardia stoliczkana*. N = 8; r = 0.885; regression equation Cs/H = 0.0103L + 0.258. Circles: *Glossocardia agassizii*. N = 14; r = 0.676; regression equation Cs/H = 0.00470L + 0.345.

Measurements (mm):

	V	L	H	L/H	Cb	Cs	Cs/H
	rv + lv	19.8	12.3	1.61	9.6	-	(0.390)*
NSMT-Mo57861	rv + lv	24.7	18.2	1.36	17.5	-	(0.481)
MUSORSTOM 6: stn DW391	rv	18.5	14.9	1.24	-	7.0	0.470
stn DW398	rv	27.8	22.3	1.25	-	11.9	0.534
stn DW418	rv	30.7	23.5	1.31	-	14.5	0.617
stn DW439	rv	12.1	8.3	1.46	-	3.3	0.398
stn DW440	lv	19.3	13.1	1.47	-	6.3	0.481
MUSORSTOM 2: stn DR33	rv	9.9	6.9	1.43	-	2.6	0.377
MUSORSTOM 3: stn DR137	lv	15.2	10.0	1.52	-	4.2	0.420

*Numericals in parentheses show Cb/2H, instead of Cs/H.

REMARKS. — Some shells from the Philippines (NSMT-Mo57861) and New Caledonia (stn DW 391, stn DW 398 and stn DW 418) are higher and more inflated than the type, and their umbonal regions are ornamented with weak and wide commarginal striae. Additional specimens are needed to determine whether or not this is a distinct species.

Glossocardia stoliczkana superficially resembles the tropical western Atlantic *G. agassizii* and young shells of *G. obesa* from the tropical West Pacific. These three species have radial rows of microscopic scales on the outer surface and a larval ligament at the anterior margin of beaks. *Glossocardia stoliczkana* differs from *G. agassizii* in having the higher and more strongly enrolled umbos, a shorter antero-dorsal margin and a wider postero-dorsal area. Commarginal striae in the postero-dorsal area of *G. agassizii* are finer and more regularly spaced than those of *G. stoliczkana*. *Glossocardia stoliczkana* clearly differs from *G. obesa* in having a distinct tertiary keel and fine commarginal lamellae on the posterior slope. The cardinal (1) in the right valve of *G. stoliczkana*, in both young and adult specimens, is lamellar and parallel to ventral margin, whereas the cardinal (1) of *G. obesa* is thin and lamellar in young shells, and is strong and triangular in adults.

Glossocardia stoliczkana is very similar to *M. hawaiana* and *M. samarangiae*, but differs from them in having a higher, thinner, shell with lower umbones, radial rows of microscopic scales on the outer surface, and a distinct tertiary keel on the yellow posterior slope (Fig. 21).

Source : MNHN, Paris

Glossocardia agassizii (Dall, 1886)

Fig. 38

Meiocardia agassizii Dall, 1886: 271 [Trinidad].

Other references:

Meiocardia agassizii — Dall, 1889: pl. 40, fig. 7) [Trinidad] . — Abbott, 1974: 5847, fig. 5848 (= Dall, 1889: pl. 40, fig. 7 [west Florida, the Caribbean, Bermuda]. — Narchi, 1976: 205-210, figs 1-3 [Rio Doce, Espirito Santo, Brazil]. — Rios, 1985: 259, pl. 91, fig. 1286 (= Dall, 1889: pl. 40, fig. 7) [Espirito Santo, Brazil].

Type material. — Depository unknown.

Type locality. — Off Trinidad.

Material examined. — Recent: **Bermuda**. "Bermuda" (MCZ 152851); 1.2 km S of Castle Rock, 144-180 m (MCZ 161960).
Cuba. 22°09'30" N, 81°11' W, Bahia de Cochinos, 315-405 m (MCZ 16504).
British Guiana. 08°10.5' N-08°10.0' N, 57°48' W, 153.6 km N of Georgetown, 96-106 m (MCZ 273570).

Distribution. — Bermuda; Cuba; Trinidad; British Guinea; Brazil (19°35' S, 39°20' W, off the mouth of the Rio Doce, Espirito State, 73 m, mud, January 1972, coll. by R.S. *"Wladimir Besnard"*, Oceanographic Institute of the University of Sao Paulo) (Narchi pers. comm.). This species is known from muddy bottoms in 73 to 405 m.

Description. — *Shell* cordiform, thin, inflated, strongly inequilateral, equivalve, with prosogyrous beaks. Mean of L/H 1.377 (N = 14, SD = 0.045), not significantly correlated with L (r = -0.146, a = 0.05). Cs/H significantly correlated with L (r = 0.676, a = 0.05) (Fig. 21). L/H not significantly correlated with Cs/H (N = 14, r = -0.000, a = 0.05). Larval ligament anterior to beak. Outer surface ornamented with weak commarginal lamellae and microscopic scales. Primary keel sharp, separating slightly concave postero-dorsal area, which has an obscure secondary keel and a narrow but conspicuous tertiary keel. Postero-dorsal area with regularly spaced commarginal lamellae. Inner surface glossy white. Anterior adductor scar semicircular; posterior adductor scar ovate; both scars nearly equal in size.

Measurements (mm):

	V	L	H	L/H	Cb	Cs	Cs/H
MCZ 16504	-	13.9	10.0	1.39	-	4.5	0.450
MCZ 152851	rv + lv	13.7	9.3	1.47	7.3	-	(0.392)*
MCZ 161960	rl	23.6	17.7	1.33	-	7.7	0.435
MCZ 273570-1	rv	27.0	18.9	1.43	-	9.6	0.508
273570-2	rv	22.6	16.7	1.35	-	7.6	0.455
273570-3	rv	17.9	13.1	1.37	.	5.7	0.435
273570-4	rv	15.8	12	1.32	-	-	-
273570-5	rv	16.5	12.1	1.36	-	4.8	0.397
273570-6	lv	22.6	16.9	1.34	.	7.3	0.432
273570-7	lv	19.0	14.1	1.35	-	6.0	0.426
273570-8	lv	17.7	13.3	1.33	-	5.8	0.436
273570-9	lv	18.6	13.0	1.43	-	5.4	0.415
273570-10	lv	18.7	13.2	1.42	-	5.7	0.432
273570-11	lv	15.2	11.4	1.33	.	4.8	0.421
273570-12	lv	14.8	10.7	1.38	-	4.6	0.430

*Numericals in parentheses show Cb/2H, instead of Cs/H.

Source : MNHN, Paris

REMARKS. — DALL (1886, 1889) described this species as a member of the genus *Meiocardia*, and American authors have apparently followed this assignment (ABBOTT, 1974; NARCHI, 1976; RIOS, 1985). It has a thin, inflated, cordiform shell, with a sharp primary keel, a prominent tertiary keel, and a larval ligament anterior to the beaks. The hinge teeth of this species are also superficially close to *Meiocardia* species of the Indo-West Pacific. The outer surface of Dall's species is ornamented with weak commarginal lamellae and numerous microscopic scales, which is similar to the ornament on *Glossocardia obesa* of the Trapezidae but which is never found on shells of *Meiocardia*. This should be therefore transfered from the genus *Meiocardia*, Glossidae, to the genus *Glossocardia*, Trapezidae.

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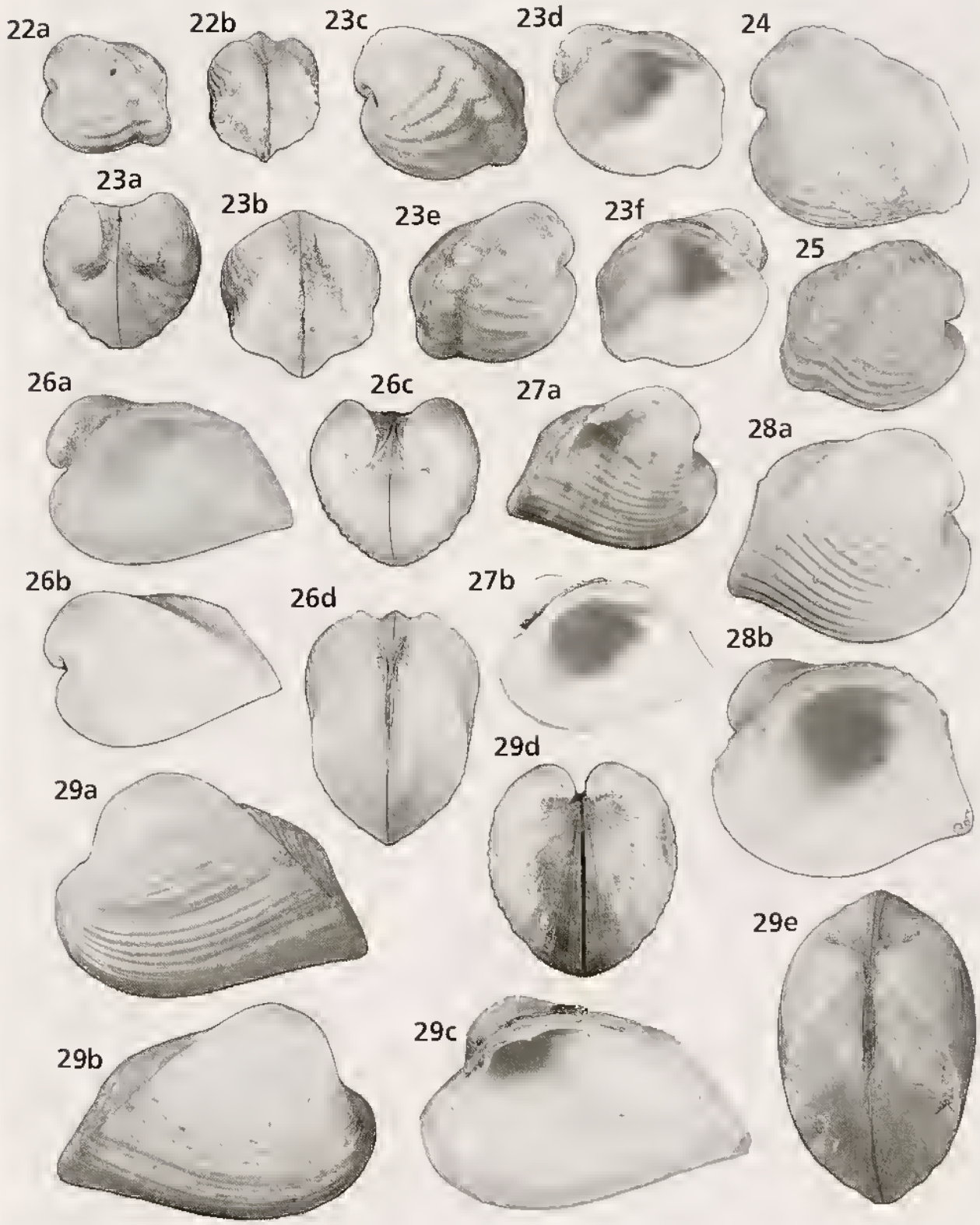
FIGS 22-29. — **22 a-b**, *Meiocardia sanguineomaculata*. REVES 2: stn 10, Seychelles (MNHN). Shell length 11.9 mm. — **a**, left side view. — **b**, postero-dorsal view. — **23 a-f**, *Meiocardia sanguineomaculata*. REVES 2: stn 30, Seychelles (MNHN). Shell length 15.0 mm. — **a**, anterior view. — **b**, posterodordal view. — **c**, left side view. — **d**, inside view of right valve. — **e**, right side view. — **f**, inside view of left valve. — **24**, *Meiocardia moltkiana*. Pleistocene Ryukyu Limestone. Kikaijima Is., Kagoshima Prefecture, Japan (NSMT-Mo69745). Shell length 33.4 mm. — **25**, *Meiocardia moltkiana*. Chichijima, Ogasawara Islands, Japan (NSMT-Mo59790). Shell length 28.2 mm. — **26 a-d**, *Meiocardia moltkiana* . China (ZMA). Shell length 33.4 mm. — **a**, inside view of right valve. — **b**, left side view. — **c**, anterior view. — **d**, postero-dorsal view. — **27 a-b**, *Meiocardia moltkiana*. MD 32: stn CP 43, Réunion (MNHN). Shell length 25.3 mm. — **a**, right side view. — **b**, inside view of the right valve. — **28 a-b**, *Meiocardia moltkiana*. SMIB 5: stn DW 81, New Caledonia (MNHN). Shell length 30.3 mm. — **a**, right side view. — **b**, inside view of the right valve. — **29 a-e**, *Meiocardia sunarangiae*. Tanabe Bay, Wakayama Prefecture, Japan (NSMT-Mo69752). Shell length 29.7 mm. — **a**, left side view. — **b**, right side view. — **c**, inside view of the right valve. — **d**, anterior view. — **e**, postero-dorsal view.

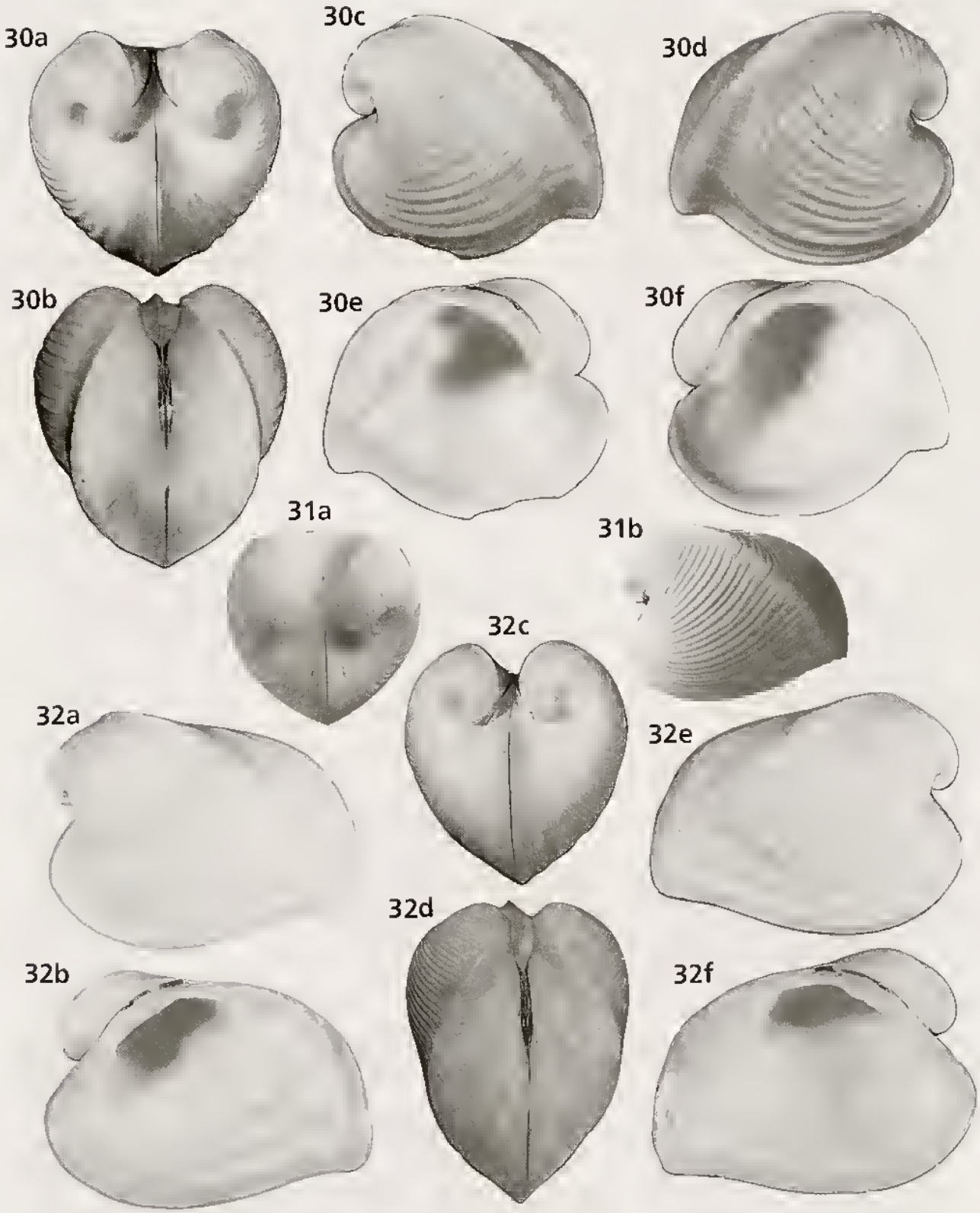
Source : MNHN, Paris



Source : MNHN, Paris

FIGS 30-32 — **30 a-f**, *Meiocardia globosa* sp. nov. Pescadores, Taiwan (holotype NSMT-Mo69749). Shell length 24.8 mm. **a**, anterior view. — **b**, postero-dorsal view. — **c**, left side view. — **d**, right side view. — **e**, inside view of the left valve. — **f**, inside view of the right valve. — **31 a-b**, *Meiocardia vulgaris*. Philippines (Habe Coll.). Shell length appr. 29 mm. — **a**, anterior view. — **b**, left side view. — **32 a-f**, *Meiocardia vulgaris*. Philippines (NSMT-Mo69747, Kawamura Coll.). Shell length 46.1 mm. — **a**, left side view. — **b**, inside view of the right valve. — **c**, anterior view. — **d**, postero-dorsal view. — **e**, right side view. **f**, inside view of the left valve.

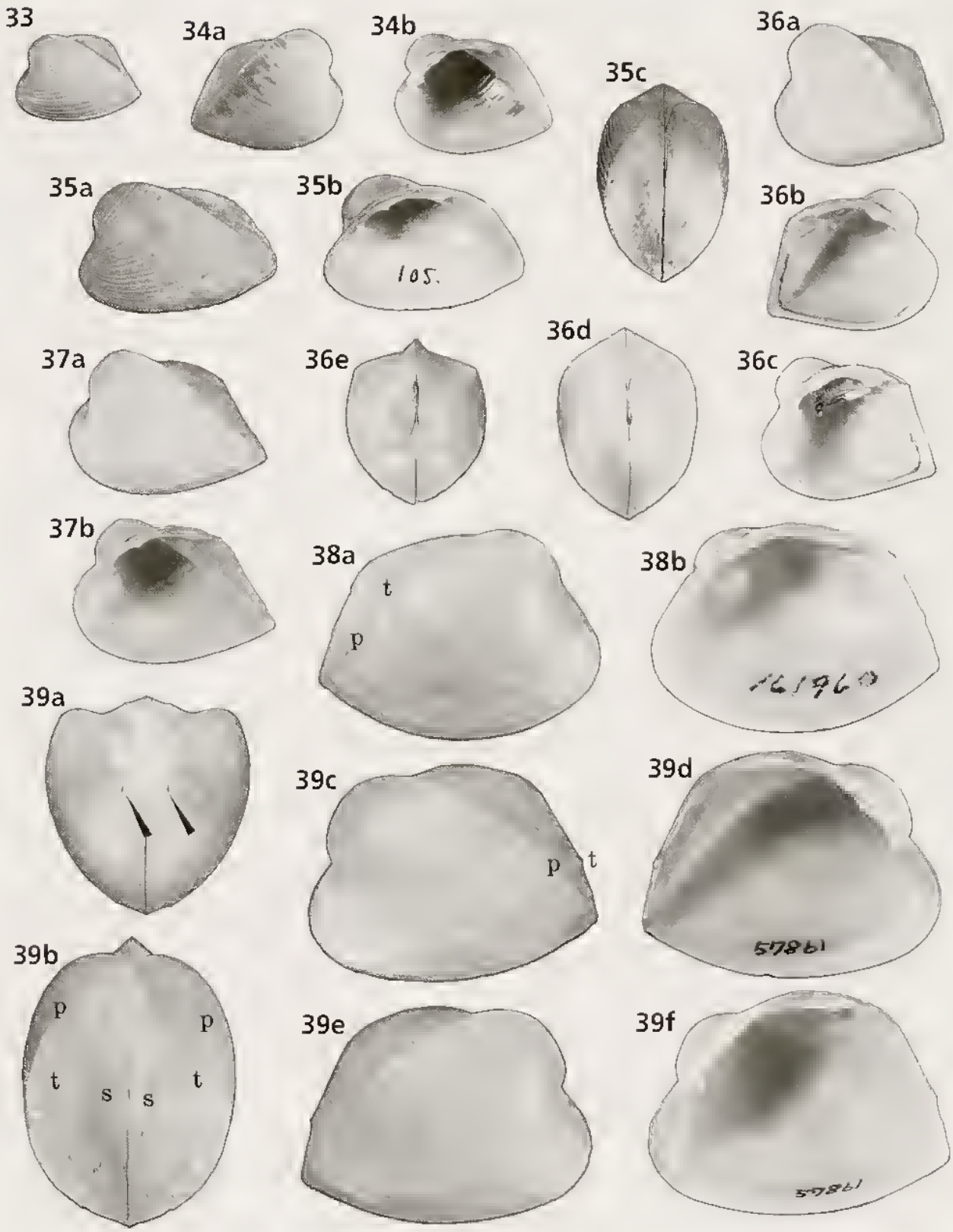
Source : MNHN, Paris



Source : MNHN, Paris

FIGS 33-39. — **33**, *Meiocardia hawaiana*. *"Siboga"*: stn 105, Sulu Archipelago (ZMA). Shell length 17.1 mm. — **34 a-b**, *Meiocardia hawaiana*. SMIB 5: stn DW 90, New Caledonia (MNHN). Shell length 17.1 mm. — **a**, right side view. — **b**, inside view of the right valve. — **35 a-c**, *Meiocardia hawaiana*. *"Siboga"*: stn 105. Sulu Archipelago (ZMA). Shell length 27.2 mm. — **a**, left side view. — **b**, inside view of the right valve. **c**, postero-dorsal view. — **36 a-e**, *Meiocardia hawaiana*. Oahu. Hawaii (USNM 807654). Shell length 14.4 mm. — **a**, left side view. **b**, inside view of the left valve. — **c**, inside view of the right valve. — **d**, dorsal view. — **e**, postero-dorsal view. — **37 a-b**. *Meiocardia hawaiana*. Kochi Prefecture, Japan (NSMT-Mo43439-1). Shell length 16.9 mm. **a**, left side view. — **b**. inside view of the right valve. — **38 a-b**, *Glossocardia agassizii*. Castle Rock, Bermuda (MCZ 161960). Shell length 23.6 mm. — **a**, right side view. **p**: Primary keel. **t**: Tertiary keel. — **b**, inside view of the right valve. — **39 a-f**, *Glossocardia stoliczkana*. Cebu, Philippines (NSMT-Mo57861). Shell length 24.7 mm. **p**: Primary keel. **s**: Secondary keel. **t**: Tertiary keel. — **a**, anterior view. Arrows indicate larval ligaments. — **b**, postero-dorsal view. — **c**, left side view. — **d**, inside view of the left valve. — **e**, right side view. — **f**, inside view of the right valve.

Source : MNHN, Paris



Source : MNHN, Paris

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Source : MNHN, Paris

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Source : MNHN, Paris

Appendix: Tables of measurements.

Table 1. — *Meiocardia moltkiana*. Measurements (mm) of selected material.

	V	L	H	L/H	Cb	Cs	Cs/H
NSMT-Mo 42307	rv + lv	18.9	15.1	1.25	13.6	-	(0.450)*
NSMT-Mo 43435	rv + lv	18.4	14.9	1.23	13.0	-	(0.436)
NSMT-Mo 43436 (1)	lv	24.9	19.6	1.27	-	10.3	(0.526)
Mo 43436 (2)	lv	13.0	10.6	1.23	-	4.8	0.453
Mo 43436 (3)	lv	11.6	9.7	1.20	-	5.1	0.526
Mo 43436 (4)	rv	10.1	7.8	1.29	-	3.7	0.474
NSMT-Mo 43455 (1)	lv	21.1	15.4	1.37	-	7.7	0.500
Mo 43455 (2)	lv	17.4	14.1	1.23	-	6.7	0.475
Mo 43455 (3)	rv	13.9	11.0	1.26	-	5.0	0.455
Mo 43455 (4)	rv	13.7	11.1	1.23	-	5.4	0.486
Mo 43455 (5)	rv	12.2	9.3	1.31	-	4.3	0.462
Mo 43455 (6)	rv	11.4	9.3	1.23	-	4.3	0.462
NSMT-Mo 59790	rv	28.2	25.5	1.11	-	14.1	0.553
NSMT-Mo 63233	rv + lv	17.1	13.5	1.27	11.4	-	(0.422)
NSMT-Mo 69739	rv + lv	22.9	17.7	1.29	16.2	-	(0.458)
NSMT-Mo 69740	rv + lv	17.5	14.8	1.18	13.3	-	(0.449)
NSMT-Mo 69741	rv + lv	28.1	21.7	1.29	21.0	-	(0.484)
NSMT-Mo 69742	rv + lv	29.7	22.9	1.30	22.3	-	(0.487)
NSMT-Mo 69743	rv + lv	22.5	18.8	1.20	18.0	-	(0.479)
NSMT-Mo 69745 (1)	lv	33.4	30.1	1.11	-	14.9	0.495
Mo 69745 (2)	rv	22.1	20.3	1.09	-	-	-
Mo 69745 (3)	lv	19.1	14.9	1.28	-	7.4	0.497
ZMA China-1	rv + lv	33.4	24.3	1.37	23.4	-	(0.481)
China-2	rv + lv	33.8	24.2	1.40	23.3	-	(0.484)
MD32 DC41 (1)	rv	17.3	13.7	1.26	-	6.4	0.467
DC41 (2)	rv	17.4	13.3	1.31	-	5.9	0.444
DC41 (3)	rv	15.6	12.7	1.23	-	6.1	0.480
DC41 (4)	rv	14.0	10.9	1.28	-	5.1	0.468
DC41 (5)	rv	11.3	8.7	1.30	-	4.1	0.471
DC41 (6)	rv	5.4	4.3	1.26	-	2.2	0.512
DC41 (7)	lv	33.2	25.0	1.33	-	12.3	0.492
DC41 (8)	lv	26.0	20.4	1.27	-	10.0	0.490
DC41 (9)	lv	25.4	20.0	1.27	-	9.6	0.480
DC41 (10)	lv	17.4	13.6	1.28	-	6.6	0.485
DC41 (11)	lv	14.5	10.8	1.34	-	5.2	0.481
DC41 (12)	lv	13.6	10.6	1.28	-	5.1	0.481
DC41 (13)	lv	8.5	6.9	1.23	-	3.7	0.536
DC41 (14)	lv	7.8	6.2	1.26	-	3.2	0.516
MD32 DC43 (1)	rv	31.4	24.0	1.30	-	11.9	0.496
DC43 (2)	rv	31.0	23.1	1.34	-	10.9	0.472
DC43 (3)	rv	29.9	23.1	1.29	-	11.4	0.494
DC43 (4)	rv	26.6	20.4	1.30	-	9.8	0.480
DC43 (5)	rv	26.0	20.3	1.28	-	9.7	0.478
DC43 (6)	rv	22.3	16.8	1.33	-	7.9	0.470
DC43 (7)	lv	32.2	23.8	1.35	-	11.8	0.496
DC43 (8)	lv	28.7	22.6	1.27	-	10.9	0.482
DC43 (9)	lv	28.2	22.1	1.28	-	10.3	0.466
DC43 (10)	lv	27.3	21.2	1.29	-	10.1	0.476
DC43 (11)	lv	26.5	20.9	1.27	-	10.0	0.478
DC43 (12)	lv	26.2	20.4	1.28	-	9.9	0.485
MD32 DC126 (1)	rv	23.2	18.6	1.25	-	8.5	0.457
DC126 (2)	rv	19.6	16.1	1.22	-	7.6	0.472
DC126 (3)	rv	17.4	13.4	1.30	-	6.0	0.448
DC126 (4)	rv	13.6	10.8	1.26	-	5.0	0.463

Source : MNHN, Paris

	V	L	H	L/H	Cb	Cs	Cs/H
DC126 (5)	rv	11.4	8.7	1.31	-	4.2	0.483
DC126 (6)	rv	10.8	8.1	1.33	·	3.9	0.481
DC126 (7)	rv	9.8	7.5	1.31	-	3.6	0.480
DC126 (8)	rv	9.7	7.2	1.35	·	3.6	0.500
DC126 (9)	rv	8.4	6.7	1.25	-	3.4	0.507
DC126 (10)	rv	8.5	6.2	1.37	-	3.2	0.516
DC126 (11)	rv	7.7	5.6	1.38	·	2.8	0.500
DC126 (12)	rv	7.5	5.7	1.32	·	2.8	0.491
DC126 (13)	rv	7.3	5.5	1.33	-	2.7	0.491
DC126 (14)	rv	6.7	5.3	1.26	-	2.7	0.509
DC126 (15)	rv	5.2	4.0	1.30	-	1.9	0.475
DC126 (16)	rv	3.8	3.1	1.23	·	1.3	0.419
DC126 (17)	lv	16.9	13.0	1.30	·	6.0	0.462
DC126 (18)	lv	14.5	11.6	1.25	·	5.4	0.466
DC126 (19)	lv	14.4	10.7	1.35	-	5.1	0.477
DC126 (20)	lv	13.3	9.8	1.36	-	4.7	0.480
DC126 (21)	lv	12.1	9.0	1.34	-	4.5	0.500
DC126 (22)	lv	9.8	7.4	1.32	-	3.6	0.486
DC126 (23)	lv	8.7	7.0	1.24	-	3.1	0.443
DC126 (24)	lv	6.9	5.6	1.23	·	3.1	0.554
DC126 (25)	lv	7.1	5.1	1.39	-	2.7	0.529
DC126 (26)	lv	6.8	5.2	1.31	-	2.4	0.462
DC126 (27)	lv	5.9	4.7	1.26	·	·	-
MD32 DC176 (1)	rv	10.4	7.5	1.39	·	4.0	0.533
DC176 (2)	lv	7.9	6.1	1.30	-	3.5	0.574
DC176 (3)	lv	6.7	5.1	1.31	·	2.7	0.529

*Numericals in parentheses show Cb/2H, instead of Cs/H.

TABLE 2 — *Meiocardia sanguineomaculata*. Measurements (mm) of selected material.

	V	L	H	L/H	Cb	Cs	Cs/H
BMNH 1910.8.31.688	rv + lv	13.6	11.3	1.20	13.0	-	(0575)*
1910.8.31.689	rv + lv	7.8	6.7	1.16	7.3	-	(0.545)
BMNH 1989178	rv + lv	17.4	14.9	1.17	14.9	-	(0.500)
1989179 (1)	rv + lv	19.3	15.7	1.23	17.7	-	(0.564)
1989179 (2)	rv + lv	19.7	17.2	1.15	18.0	-	(0.523)
1989179 (3)	rv + lv	6.0	5.0	1.20	4.6	·	(0.460)
USNM 235929	lv	10.3	10.1	1.02	·	5.1	0.505
USNM 235950	rv	10.5	9.8	1.07	·	4.9	0.500
USNM 237240	rv	(18)	15.4	·	·	7.0	0.455
USNM 294513 (1)	lv	9.0	7.9	1.14	·	3.8	0.481
294513 (2)	lv	5.0	4.5	1.11	-	2.2	0.489
294513 (3)	lv	3.0	2.5	1.20	-	1.5	0.600
294513 (4)	lv	2.2	2.0	1.10	-	1	0.500
294513 (5)	rv	4.6	3.9	1.18	-	2.0	0.513
294513 (6)	rv	4.0	3.4	1.18	-	1.8	0.529
USNM 294545 (1)	rv	4.5	3.4	1.18	·	1.8	0.529
294545 (2)	lv	9.0	7.3	1.23	·	4.1	0.562
USNM 431190 (1)	rv	8.0	7.4	1.08	-	3.6	0.486
431190 (2)	rv	8.1	6.6	1.23	·	3.6	0.545
431190 (3)	rv	4.6	4.4	1.05	·	2.2	0.500
431190 (4)	lv	12.0	10.8	1.11	-	5.4	0.500
431190 (5)	lv	8.5	8.2	1.04	·	4.1	0.500
431190 (6)	rv	4.0	3.4	1.18	-	1.18	0.529
REVES 2 Stn 30	rv + lv	15.0	12.4	1.21	13.6	-	(0.548)
Stn 24	rv + lv	13.2	11.9	1.11	11.8	-	(0.496)

Source : MNHN, Paris

	V	L	H	L/H	Cb	Cs	Cs/H
Stn 18	rv + lv	19.3	16.6	1.16	17.8	-	(0.536)
Stn 16	rv + lv	10.9	9.7	1.12	9.0	-	(0.464)
Stn 10	rv + lv	11.9	10.0	1.19	9.5	-	(0.475)

*Numericals in parentheses show Cb/2H, instead of Cs/H.

TABLE 3. — *Meiocardia vulgaris*. Measurements (mm) of selected material.

	V	L	H	L/H	Cb	Cs	Cs/H
BMNH syntypes 1	rv + lv	48.6	38.6	1.26	36.0	-	(0.466)*
2	rv + lv	37.6	31.9	1.18	31.4	-	(0.492)
3	rv + lv	38.2	30.5	1.25	30.7	-	(0.503)
4	rv + lv	36.4	29.3	1.24	28.6	-	(0.488)
MUSORSTOM 3 CP141	rv + lv	25.0	21.1	1.18	19.7	-	(0.467)
CORINDON Stn 205 (1)	rv + lv	14.6	13.8	1.06	13.4	-	(0.486)
Stn 205 (2)	rv + lv	14.1	13.2	1.07	13.3	-	(0.504)
Stn 205 (3)	lv	14.2	12.7	1.12	-	6.7	0.528
ZMA China (1)	rv + lv	34.3	27.8	1.23	26.7	-	(0.480)
China (2)	rv + lv	33.3	27.3	1.22	26.5	-	(0.485)
China (3)	rv + lv	23.9	21.5	1.11	21.2	-	(0.493)
China (4)	rv + lv	23.5	20.0	1.18	20.0	-	(0.500)
NSMT-Mo 54938	rv	24.3	20.3	1.20	-	9.9	0.488
NSMT-Mo 60557	rv + lv	31.5	26.2	1.20	24.9	-	(0.475)
NSMT-Mo69746	rv + lv	29.6	25.2	1.17	23.7	-	(0.470)
NSMT-Mo 69747 (1)	rv + lv	39.3	30.5	1.29	30.3	-	(0.497)
Mo 69747 (2)	rv + lv	36.4	29.3	1.24	27.7	-	(0.473)
NSMT-Mo 69748 (1)	rv + lv	46.1	35.0	1.32	32.4	-	(0.463)
Mo 69748 (2)	rv + lv	35.5	28.7	1.24	26.3	-	(0.458)

*Numericals in parentheses show Cb/2H, instead of Cs/H.

TABLE 4. — *Meiocardia hawaiana*. Measurements (mm) of selected material.

	V	L	H	L/H	Cb	Cs	Cs/H
NSMT-Mo 43439 (1)	rv + lv	16.9	13.0	1.30	12.0	-	(0.462)*
Mo 43439 (2)	rv + lv	19.1	14.8	1.29	14.5	-	(0.490)
MUSORSTOM 3 CP143 (1)	rv + lv	27.4	20.5	1.34	19.2	-	(0.468)
CP143 (2)	rv + lv	22.4	17.6	1.27	16.3	-	(0.463)
CP143 (3)	rv	28.9	21.9	1.32	-	10.9	0.498
CP143 (4)	rv	24.4	19.7	1.24	-	9.5	0.482
CP143 (5)	rv	23.7	18.4	1.29	-	8.8	0.478
CP143 (6)	rv	22.3	18.1	1.23	-	8.3	0.459
CP143 (7)	rv	20.9	16.0	1.31	-	7.6	0.475
CP143 (8)	rv	17.9	14.3	1.25	-	6.9	0.483
CP143 (9)	lv	27.7	22.1	1.25	-	10.4	0.471
CP143 (10)	lv	26.6	21.7	1.23	-	10.5	0.484
CP143 (11)	lv	26.4	20.1	1.31	-	10.3	0.512
CP143 (12)	lv	25.7	19.2	1.34	-	10.0	0.521
CP143 (13)	lv	25.4	19.5	1.30	-	9.7	0.497
CP143 (14)	lv	22.2	17.2	1.29	-	8.0	0.465
CP143 (15)	lv	21.9	17.8	1.23	-	7.9	0.444
CP143 (16)	lv	20.6	16.1	1.28	-	7.9	0.491
MUSORSTOM 1 Stn19	rv + lv	12.3	9.8	1.26	9.3	-	(0.474)

*Numericals in parentheses show Cb/2H, instead of Cs/H.

Source : MNHN, Paris

3

Carnivorous bivalve molluscs (Anomalodesmata) from the tropical western Pacific Ocean, with a proposed classification and a catalogue of Recent species

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Source : MNHN, Paris

ABSTRACT

This paper deals with 37 species of carnivorous anomalodesmatan bivalves usually assigned to the septibranchs, originating from the Philippines, Indonesia and New Caledonia. Eight species are described as new: *Cetocoucha boucheti, C. exigua, Cuspidaria morrisae, C. (Soyomya) clathrata, Halicardia houbricki, Haliris teporis, Myonera rostra* and *Policordia olivacea*. New names are also provided here for two species with preoccupied names: *Policordia ivanovae*, for *P. japonica* Ivanova, 1977, and *Myonera alleni* for *Cuspidaria (Myonera) atlantica* Allen & Morgan, 1981. A new classification of the carnivorous Anomalodesmata, based on F. R. Bernard's latest works, is proposed together with diagnoses of the supraspecific taxa and a catalogue of the living known species.

RÉSUMÉ

Mollusques Bivalves carnivores (Anomalodesmata) des régions tropicales du Pacifique occidental, avec une nouvelle classification et un catalogue des espèces actuelles.

Cet article décrit 37 espèces de bivalves carnivores Anomalodesmata traditionnellement qualifiés de septibranches provenant des îles Philippines, d'Indonésie et de Nouvelle-Calédonie. Huit espèces sont nouvelles pour la science : *Cetocoucha boucheti, C. exigua, Cuspidaria morrisae, C. (Soyomya) clathrata, Halicardia houbricki, Haliris teporis, Myonera rostra* et *Policordia olivacea*. De nouveaux noms ont aussi été attribués à deux espèces aux noms préoccupés: *Policordia ivanovae*, pour *P. japonica* Ivanova, 1977, et *Myonera alleni* pour *Cuspidaria (Myonera) atlantica* Allen & Morgan, 1981. Une nouvelle classification des Anomalodesmata carnivores, fondée sur les derniers travaux de F. R. Bernard, est présentée ainsi que des diagnoses des différents taxa supraspécifiques et un catalogue des espèces vivantes actuellement connues.

INTRODUCTION

FOREWORD

The present paper is based on a manuscript of the second author, the late Dr Frank R. Bernard. At the end of 1988, Dr P. Bouchet showed me a first draft of a manuscript on West Pacific septibranch bivalves for which Dr Bernard wanted to have my comments before its completion, because I knew of the material he dealt with, having had the opportunity to study it partly and to publish a few papers about it. I quickly gave him an answer, but Dr Bernard could not work further on this paper and died shortly after, 29 March 1989. Later, the material on loan to him was returned to Paris, through the courtesy of Drs Glen S. Jamieson of the Pacific Biological Station, Nanaimo, and James A. Cosgrove of the Royal British Columbia Museum, Victoria, British Columbia (Canada). I was then asked by P. Bouchet to revise Bernard's draft for publication.

As it was already apparent to me in 1988, the manuscript was far from complete and could not be published without substantial revision. But it seemed worthwhile to do it, especially because of its classification of carnivorous Anomalodesmata, which can be considered as the outcome of Dr Bernard's ideas on the systematics of the septibranch group (for a review of F. R. Bernard's contributions, see MATSUKUMA, 1989).

Although I have greatly amended and completed the original manuscript, or even written many points in it, I tried to respect F. R. Bernard's personal opinions. However, in a few instances, when I could not agree with his interpretation of the material reported in this paper, I have decided against it. One of the new species described here (*Policordia olivacea*) is in this case.

J.-M. Poutiers

MATERIAL AND METHODS

The bivalve mollusc material reviewed in this paper, kindly provided by Dr P. Bouchet, comprises carnivorous anomalodesmatan species usually assigned to the septibranchs. It originates from several French expeditions organized in recent years in the Pacific Ocean, and comprises:

Source : MNHN, Paris

— Material collected during two expeditions by MNHN and ORSTOM to the central Philippines under the direction of Prof. J. Forest (MNHN): MUSORSTOM 1 in 1976 aboard N.O. *"Vauban"* (FOREST, 1981), and MUSORSTOM 2 in 1980 aboard N.O. *"Coriolis"* (FOREST, 1986).

Material collected during the CORINDON 2 cruise organized in 1980 by ORSTOM to the Straits of Makassar between Borneo and Sulawesi (Indonesia) aboard N.O. *"Coriolis"*, with J. Forest responsible for biological data.

— Material collected by P. Bouchet and A. Warén off southern New Caledonia in 1978-79, aboard N.O. *"Vauban"* (RICHER DE FORGES, 1990).

Most of the finer residues from these expeditions was sorted by the Centre National de Tri d'Océanographie Biologique (CENTOB, IFREMER, Brest).

Unless otherwise stated, all material including holotypes is deposited in MNHN. Parts of the material collected in New Caledonia and in the Philippines during MUSORSTOM 1 expedition have been already investigated (MORTON, 1987; POUTIERS, 1981, 1982a, b, 1985).

A species from the USNM collections, dredged in 1909 by the *"Albatross"* during its Philippines expedition (BOWERS, 1910), has been added through the courtesy of the late Dr R. S. Houbrick.

The material comprises 37 species taken at 69 stations at depths from 70 to 1628 m. A list of stations, with main geographical and bathymetrical data and collected species, is presented in Appendix 1. Illustrations, bathymetric and geographic distributional data and a brief systematic description are given for each species taken. The known synonyms are listed, but no attempt has been made to cite all subsequent usages.

The descriptive section of this paper is followed by a brief summary of the classification, reflecting mainly F.R. Bernard's personal opinion. This synopsis has been improved and updated with as few modifications as possible, notably through the insertion of genus-group taxa introduced in 1983 by SCARLATO & STAROBOGATOV. Short diagnoses are provided for the supraspecific Recent taxa, with a listing of all the species belonging in each genus (or subgenus). A general list of the binomina has also been included at the end of this section. The authors have attempted to make this catalogue as comprehensive as possible, but it is likely to be incomplete. A free translation of the key paper by SCARLATO & STAROBOGATOV (1983) referred above is provided in Appendix 2.

Since 1984, when the material reported in this paper was sent to F. R. Bernard for study, a number of additional deep-sea expeditions have been led by the Paris Museum and ORSTOM in the Philippines (MUSORSTOM 3, 1985), in Indonesia (KARUBAR, 1991), and mainly in the New Caledonian economic zone (for a review of cruises in this area, see RICHER DE FORGES, 1990, 1993). They have resulted in many samples of carnivorous anomalodesmatan Bivalves which will form the subject of forthcoming papers in which the first author will provide more personal views on septibranch classification.

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

AMS : Australian Museum, Sydney
MNHN : Muséum national d'Histoire naturelle, Paris
NMNZ : Museum of New Zealand, Wellington
NSMT : National Science Museum, Tokyo
USNM : National Museum of Natural History, Washington, DC

Other abbreviations

db : paired valves, dead collected
spm(s) : live-taken specimen(s)
v : valve(s)
OD : original designation.

Source : MNHN, Paris

SPECIES ACCOUNTS

Family VERTICORDIIDAE

Spinosipella costeminens (Poutiers, 1981)

Figs 1-2

Verticordia (Spinosipella) costeminens Poutiers, 1981: 351, pl. 4, figs 1-4, text-fig.5.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 49, 13°49′ N, 120°00.5′ E, 750-925 m, 3 spms (holotype and paratypes).
MUSORSTOM 2: stn 55, 13°53.4′ N, 19°57.8′ E, 865-866 m, 3 spms, 3 db, 5 v.

DISTRIBUTION. — Only known from the Central Philippines, in 750-925 m.

DESCRIPTION. — *Shell* inflated, rather large for the genus, subquadrate, with spirally twisted umbones. With 16-17 thin, produced, blade-like radial ribs, one of which is much more prominent than the others and runs from umbo to the posteroventral angle of shell. Exterior surface covered with radial rows of small spines. Internal ligament short, arcuate, reinforced by a large lithodesma. *Right valve* with a strong, conical, posteriorly recurved cardinal tooth. *Left valve* with a small corresponding denticle. Interior pearly white, with the external ribbing showing through. Margins deeply indented. Length: 23.5 mm.

REMARKS. — This elegant large species is distinguished by the blade-like shape of its radial ribs and the prominent umbono-posterior keel.

Spinosipella deshayesiana (P. Fischer, 1862)

Figs 7-9

Verticordia deshayesiana P. Fischer, 1862: 35, pl. 5, figs 10-11 (Published 7 January 1862).

Synonym:
Verticordia japonica A. Adams, 1862: 224 (Published in March 1862).

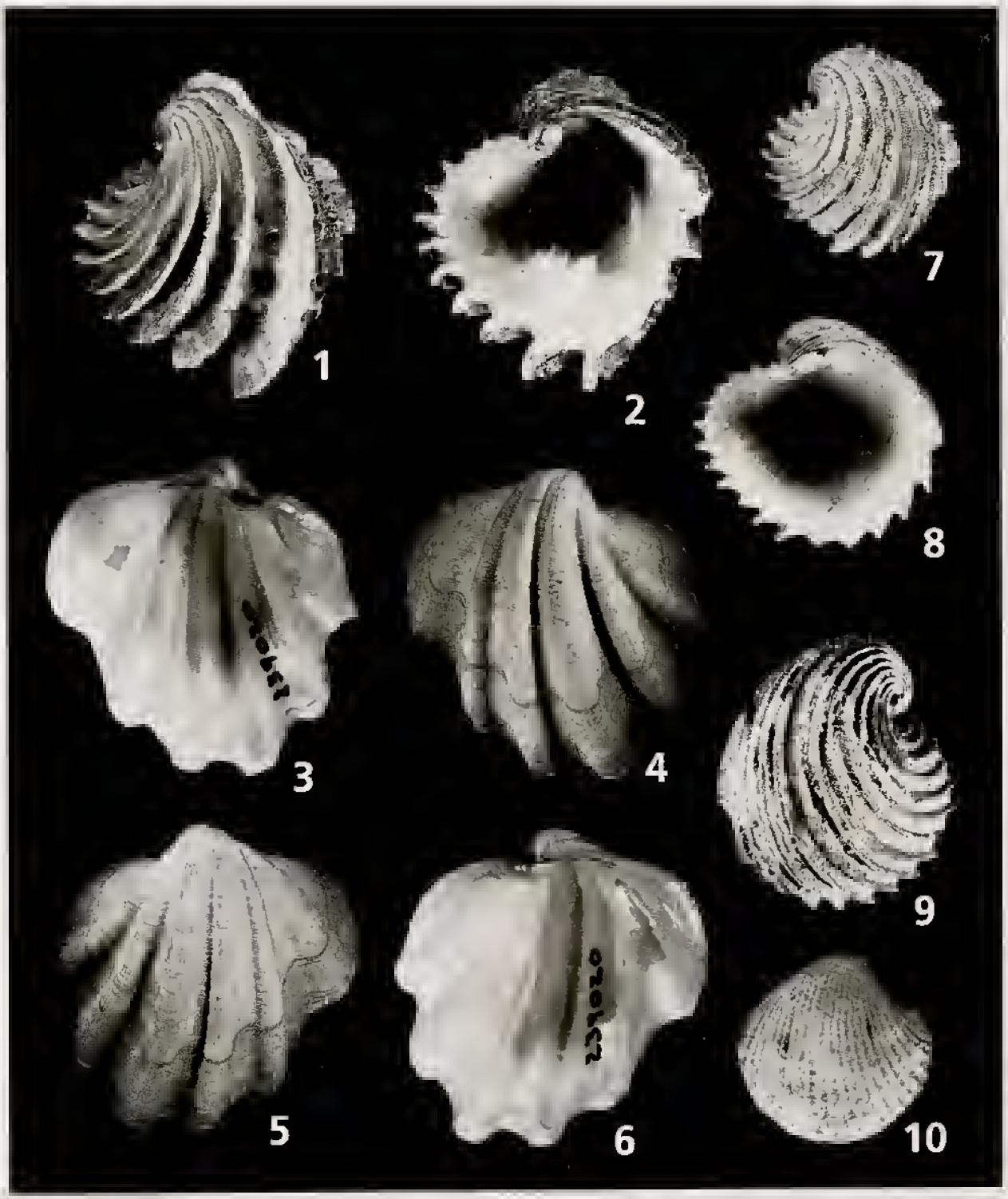
MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 33, 13°32′ N, 121°07.5′ E, 130-137 m, 3 v. — Stn 51, 13°59.8′ N, 120°17′ E, 170-187 m, 1 v.
New Caledonia. *"Vauban"* 1978-79: stn 2, 22°17′ S, 167°14′ E, 425-430 m, 2 v. — Stn 4, 22°17′ S, 167°13′ E, 400 m, 3 v. — Stn 15, 22°49′ S, 167°12′ E, 390-395 m, 3 v. — Stn 16, 22°46′ S, 167°12′ E, 390-400 m, 2 v. — Stn 42, 22°08′ S, 167°04′ E, 230-260 m, 2 v.

DISTRIBUTION. — Indo-Pacific, East Africa, Indonesia, Thailand, South and East China Sea, Honshu, Japan to Hawaii and New Caledonia, in 40-693 m (HIGO & GOTO, 1993).

DESCRIPTION. — *Shell* solid, globose, rounded to ovate. Umbones prominent, spirally twisted, overhanging a small, deeply impressed lunule. Radial ribs strong and sharp, covered on crests with small prickly granules; interspaces with numerous, closely set, fine pustules more or less radially aligned. Internal ligament reinforced by a strong lithodesma. Hinge of *right valve* with a large, conical, cardinal tooth. *Left valve* with a smaller corresponding denticle. Interior nacreous. Inner margins deeply crenulated. Length: 16.1 mm.

REMARKS. — The shell of this species is somewhat variable in rib number and general shape, larger specimens tending to be proportionately higher. Its relationships to the Atlantic *S. acuticostata* (Philippi, 1844) and the Indo-Pacific *S. ericia* (Hedley, 1911) have not yet been clearly elucidated. The latter is said to have a wide distribution (CROZIER, 1966) and to be smaller, rounder, with less

Source : MNHN, Paris



FIGS 1-10. — Verticordiidae — **1-2**, *Spinosipella costeminens*, MUSORSTOM 2: stn 55, L = 19.2 mm, exterior of left valve (1), interior of right valve (2). — **3-6**, *Halicardia houbricki* sp. nov., *"Albatross"*: stn 5582, holotype, L = 34.6 mm, interior of left valve (3), exterior of right valve (4), exterior of left valve (5), interior of right valve (6). — **7-9**, *Spinosipella deshayesiana*: **7-8**, *"Vauban"* 1978-79: stn 42, L = 9.1 mm, exterior of left valve (7), L = 11.2 mm, interior of right valve (8); **9**, *"Vauban"* 1978-79: stn 4, L = 16.1 mm, exterior of right valve (9). — **10**, *Haliris multicostata*, MUSORSTOM 2: stn 33, L = 6.9 mm, exterior of right valve.

Source : MNHN, Paris

prominent umbones. However, these features seem rather mutable and may prove to fall within the range of individual or ontogenetic variations.

Haliris multicostata (A. Adams, 1862)

Fig. 10

Verticordia multicostata A. Adams, 1862: 224.

Synonym:
Verticordia (Haliris) moeshimaensis Habe, 1953: 133.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 33, 13°32′ N, 121°07.5′ E, 130-137 m, 5 v.
New Caledonia. *"Vauban"* 1978-79: stn 2, 22°17′ S, 167°14′ E, 425-430 m, 7 v. — Stn 40, 22°30′ S, 166°24′ E, 250-350 m, 5 v.

DISTRIBUTION. — Western Pacific, New Caledonia, the Philippines, South and East China Sea to Honshu, Japan, in 50-450 m.

DESCRIPTION. — *Shell* small, inflated, cordiform. Inequilateral, with anterior, prosogyrate umbones and strongly developed, shallow lunule. Sculpture of rounded, imbricated or nodulose radial riblets and numerous fine granules. Lithodesma thin, lamelliform. *Right valve* with a stout conical cardinal tooth and a lateral ridge under posterodorsal margin. Interior of valves subnacreous. Inner shell margin regularly crenulate. Length: 6.9 mm.

Haliris teporis sp. nov.

(Figs 11-14)

TYPE MATERIAL. — Holotype live taken, MNHN.

TYPE LOCALITY. — New Caledonia. *"Vauban"* 1978-79, stn 3, 22°17′ S, 167°12′ E, 390 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

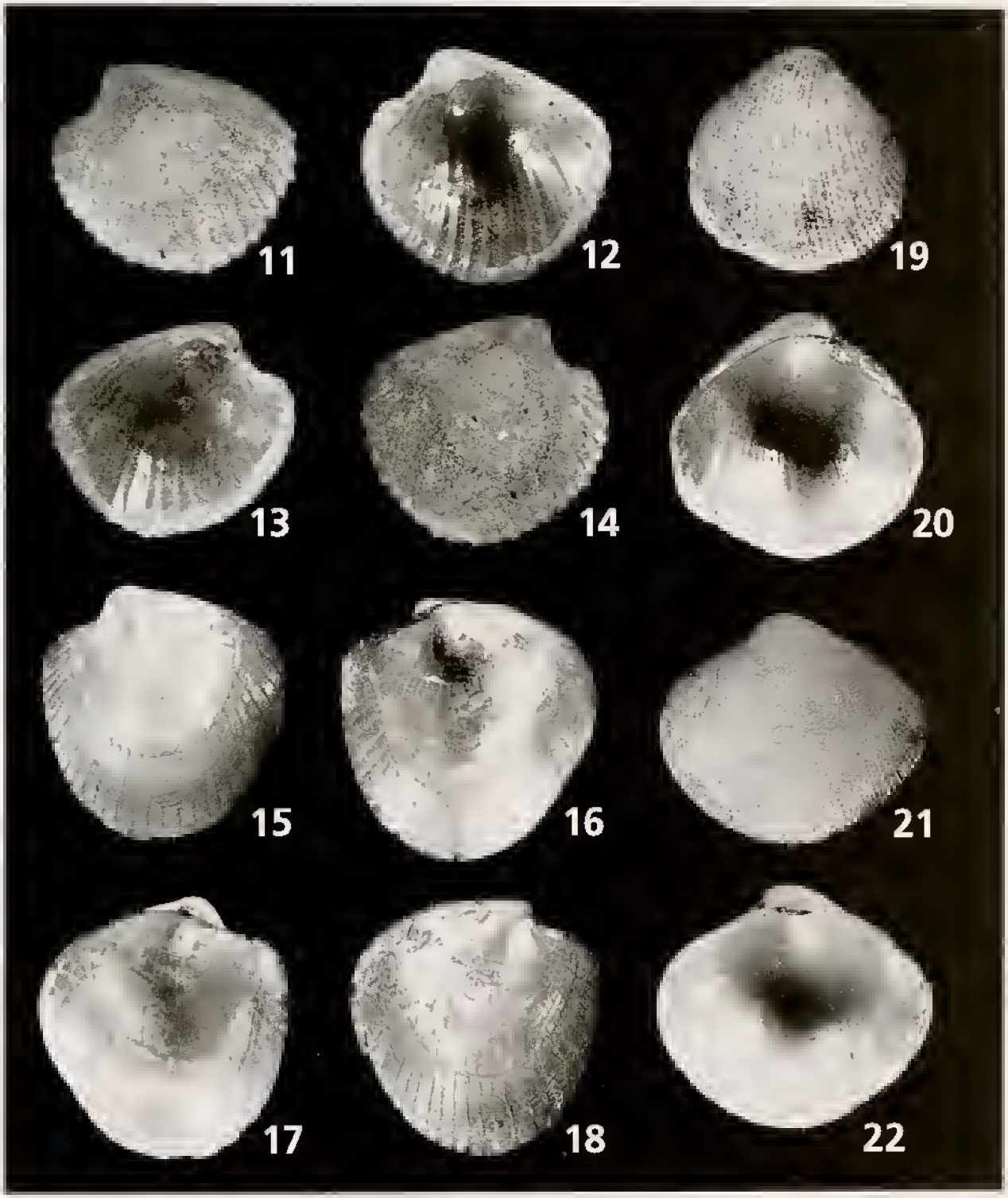
DESCRIPTION. — *Shell* minute, oval subquadrate, rather compressed, inequilateral. Umbones prosogyrate, not prominent, situated at approximately anterior one third of shell length. Slightly inequivalve, left valve somewhat deeper and larger, overlapping a little the opposite valve along margins. Anterodorsal margin short, a little depressed along lunule, somewhat curled up to meet the rounded anterior and ventral margins. Posterodorsal margin elongate, oblique and feebly convex, forming a blunt angle with the broadly arcuate posterior margin. Sculpture of about 25 delicate radial riblets; riblets and interspaces covered with tiny prickly granules. Lunule small, relatively deep. Periostracum adherent, tenuous, pale straw in colour, extending somewhat over the inner shell margin. Internal ligament reinforced by a lithodesma, subquadrate in outline with slightly produced posterior angles. *Right valve* with a conical cardinal tooth and an obscure lateral ridge under the posterodorsal margin. Hinge of *left valve* edentate, with a small subumbonal indentation to fit the opposite tooth. Interior polished, subnacreous, with radial furrows and inner margin crenulations corresponding to outer radial sculpture.

Measurements: Length 3.0 mm, height 2.8 mm, inflation 2.0 mm. The single specimen consists of a set of valves with its lithodesma. The soft parts were sent to F. R. Bernard, but are now missing.

REMARKS. — This small species is distinct in outline from *H. multicostata*, which also occurs in New Caledonia, and the delicate radial riblets of its outer surface are characteristic.

ETYMOLOGY. — The specific name alludes to the habitat of the species. It is derived from the Latin *tepor*, meaning lukewarm.

Source : MNHN, Paris



FIGS 11-22. — **11-14**, Verticordiidae: *Haliris teporis* sp. nov., *"Vauban"* 1978-79: stn 3, holotype, L = 3.0 mm, exterior of left valve (11), interior of right valve (12), interior of left valve (13), exterior of right valve (14). — **15-18**, Lyonsiellidae: *Policordia olivacea* sp. nov., CORINDON: stn 231, holotype, L = 15.3 mm, exterior of left valve (15), interior of right valve (16), interior of left valve (17), exterior of right valve (18). — **19-22**, Euciroidae — **19-20**, *Euciroa crassa*, MUSORSTOM 2: stn 68, L = 12.3 mm, exterior of right valve (19), L = 14.1 mm, interior of left valve (20). — **21-22**, *Euciroa millegemmata*, MUSORSTOM 2: stn 19, L = 15.3 mm, exterior of left valve (21), interior of right valve (22).

Source : MNHN, Paris

Halicardia houbricki sp. nov.

Figs 3-6

TYPE MATERIAL. — Holotype empty shell, USNM 239020.

TYPE LOCALITY. — Northeastern Borneo, *"Albatross"*, stn 5582, 4°19.9′ N, 118°58.6′ E, 1628 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* large, solid, inflated, nearly as long as high, irregularly trigonal in outline. Inequilateral, with the anterior half of disc ventrally expanded and an alate, somewhat compressed laterally, posterodorsal slope. Lunule small, deeply impressed, overhung posteriorly by the umbones, more developed in right valve. Umbones prosogyrate, inflated and moderately prominent, in front of midlength of shell. Right valve tending to overlap the opposite valve, a little along posterodorsal margin, more evidently on lunular area, making the shell slightly inequivalve. External sculpture of six strong radial undulations that scallop ventral margin, and numerous, narrow, unequal radiating grooves. Concentric growth marks well impressed, giving a finely decussate effect with the radial elements. Outer shell surface covered with densely set small granules. Periostracum thin, adherent, light beige in colour, slightly thicker on periphery of shell and somewhat reinforcing the radiating grooves. External ligament a long, narrow brown band stretching along posterodorsal and lunular margins. Internal ligament opisthodetic, leaving in each valve a trigonal, elongate groove pointing obliquely under umbo. Lithodesma large, asymmetrical. Hinge feeble, nearly edentate: left valve slightly protruding on middle of posterodorsal margin; cardinal tubercle of right valve obsolete, reduced to a faint ridge of lunular margin under umbo. Inner side of shell pearly white, smooth, largely scalloped by the exterior radial undulations. Anterior adductor scar distinct, semilunar, bordered internally by a slight thickening of shell. Posterior adductor scar a little larger, less impressed, roughly subquadrate, with a short dorsal expansion corresponding to posterior pedal retractor scar. Anterior retractor scar deeply impressed, globular, hooked ventrally, situated beneath lunular margin. Umbonal cavity with a very small, ovate muscle scar under resilifer. Pallial line narrow, not indented by a sinus, remote from ventral margin.

Measurements: Length 34.6 mm, height 35.3 mm, inflation 28.8 mm. The single specimen consists of a set of valves in fresh condition. The lithodesma is unfortunately now missing, but was observed by F. R. Bernard.

REMARKS. — The new species closely resembles the North Eastern Pacific *H. perplicata* (Dall, 1890) but is readily distinguished by the straighter posterodorsal margin, the proportionately larger lithodesma, the smaller dental tubercle of the right valve and the much finer surface granulations.

It is very distinct from the three other Recent *Halicardia* species previously known from the North Pacific area: *H. nipponensis* Okutani, 1957, from Japan, and *H. gouldi* Dall, Bartsch & Rehder, 1938, from Hawaii, are characterized by radial flexures rather than distinct ribs; *H. philippinensis* Poutiers, 1981, from the central Philippines, has a slender, much thinner shell with delicate external sculpture.

ETYMOLOGY. — The species is named in honour of the late Dr R. S. Houbrick of the Smithsonian Institution, Washington, DC for his numerous and valuable contributions to malacology.

Halicardia philippinensis Poutiers, 1981

Figs 81-82

Halicardia philippinensis Poutiers, 1981: 353, textfig. 6, pl. 4, figs 7-8.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 44, 13°46.5′ N, 120°29.5′ E, 592-610 m, 1 spm (holotype), 2 spms, 1 db (paratypes) (MNHN).

DISTRIBUTION. — Only known from the Central Philippines, in 592-610 m.

Source : MNHN, Paris

DESCRIPTION. — *Shell* inflated, brittle, higher than long, subequivalve, roughly trigonal in outline. Inequilateral, ventral margin anteriorly expanded, posterodorsal margin somewhat alate. Sculpture reduced, with a shallow depression radiating to the slight sinuosity of posteroventral margin, and with numerous radial grooves and densely set small granules. Internal ligament opisthodetic, leaving in each valve a long and narrow oblique groove. Lithodesma large, horseshoe-shaped, with pointed posterior lobes. *Right valve* with a posteriorly recurved cardinal tooth. *Left valve* edentate. Interior nacreous, with the external sculpture showing through posteriorly. Inner shell margins sharp and smooth. Length: 21.3 mm.

REMARKS. — *Halicardia philippinensis* is closely related to the Hawaiian species *H. gouldi* Dall, Bartsch & Rehder, 1938. However, it differs from the latter by the higher shape with more rounded outline, a posterodorsal expansion more weakly demarcated from disk, and an evenly convex anterior margin, not flattened or depressed in the middle.

Family LYONSIELLIDAE

Policordia olivacea Poutiers, sp. nov.

Figs 15-18

TYPE MATERIAL. — Holotype live taken, MNHN.

TYPE LOCALITY. — Indonesia. CORINDON, stn 231, 0°04.9′ N, 119°47.8′ E, 980-1080 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* brittle, trapezoidal, rather compressed. Inequivalve, with a flexuous commissural plane and a slightly larger but less inflated right valve. Inequilateral, umbones anterior, prosogyrate, not very prominent. Anterodorsal margin rather short, abruptly curved; posterodorsal margin long, slightly convex. Ventral margin forming a narrowly rounded expansion. Posterior slope set off by a slightly depressed radial undulation. Sculpture of 34-39 fine radial striae with raised periostracal fringes, and many concentric lines forming fine lirae on lateral slopes. Shell translucent, whitish, with an oily iridescence, covered with a thin adherent periostracum, pale olive-brown in colour. Hinge margin thin, edentate, only slightly protruding under and behind umbo of left valve. Anterodorsal margin covered in both valves with a thickened outgrow of periostracum. Ligament opisthodetic, with a strong, bifid, recurved lithodesma, obliquely inserted under posterodorsal margin of valves. Interior nacreous, with the external sculpture showing through. Attachment scars obscure.

Anatomy: Adductor muscles ovate, subequal, the posterior one slightly larger. Mantle rather solid, marginally thickened, extensively fused, with a small pedal opening. Entire free edge of each mantle lobe with a series of squat sensory tubercles. Exhalant opening with lateral tissue pads and five unbranched conical tentacles, three dorsally and two apart ventrally. Inhalant aperture larger, with an extensive raptorial hood, surrounded on either side by ten prominent, partially fused tentacles. These are branched into seven lobes and densely covered with microscopic pointed papillae. Two additional pairs of small, simple, conical tentacles inserted obliquely on outer edge of the ring of inhalant tentacles, one pair in the interstices between the fourth and fifth tentacles, and another pair between the sixth and seventh ones. Septum thin and delicate; gills with inner and outer demibranch, the ascending lamella of the outer demibranch absent. Gill filaments short. Foot small, rather tongue-shaped, with a byssal groove but no trace of a functional byssus. Mouth large, with overhanging lips; labial palps small.

Measurements: Length 15.3 mm, height 15.8 mm, inflation 9.2 mm. The single specimen consists of a set of valves with preserved soft parts. The lithodesma is now missing, but was observed by F. R. Bernard.

REMARKS. — This new species shows marked similarities with *Policordia densicostata* (Locard, 1898) of the subtropical Atlantic, a rather variable form, difficult to separate from *P. gemma* (Verrill, 1880) and *P. atlantica* Allen & Turner, 1974 on shell characters alone. Considering there were some doubt about the relationships between these three species, F. R. Bernard postulated that a variable complex is represented in the Atlantic, and tentatively assigned the CORINDON specimen to *P. densicostata*. However, after an examination of Locard's type specimen in MNHN, and the study of material assigned to *P. densicostata* by ALLEN & TURNER (1974: 478), I cannot agree with the opinion of Bernard and consider the CORINDON specimen a distinct species [J.-M. P.].

Source : MNHN, Paris

Policordia olivacea differs from *P. densicostata* by its compressed shell (length/inflation ratio 1.66 instead of 1.30), a more protruding ventral margin giving a somewhat trigonal outline, less prominent umbones, and a more conspicuous, light olive-brown periostracum (tenuous and pale grey to beige in *P. densicostata*). On anatomical grounds, both species are easily distinguishable by the mantle free margins (devoid of tubercles in *P. densicostata*) and the tentacles surrounding the inhalant aperture (*P. densicostata* has two more branched tentacles but no additional simple tentacles on their outer edge).

Policordia olivacea has a general resemblance to the West Pacific *P. pilula* (see PRASHAD, 1932 for description and illustration of the shell), a much smaller, differently shaped species. It is likely that *P. media* Okutani, 1962, is identical to *P. pilula*.

ETYMOLOGY. – The specific name is derived from the Latin *oliva*, olive, with reference to the colour and oily iridescence of the new species.

Family EUCIROIDAE

Euciroa crassa Thiele & Jaeckel, 1931

Figs 19-20

Euciroa crassa Thiele & Jaeckel, 1931: 248, pl. 10, fig. 130.

Synonym:

Euciroa cistagemma Kuroda, 1952: 14, pl. 1, figs 16-18.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 2, 14°00.5′ N, 120°17.3′ E, 184-186 m, 1 v. — Stn 6, 13°56.5′ N, 120°21.5′ E, 136-152 m, 1 v. — Stn 10, 14°00.7′ N, 120°18.2′ E, 188-195 m, 1 v. — Stn 17, 14°00.5′ N, 120°17.8′ E, 174-193 m, 1 v. — Stn 26, 13°49′ N, 120°50.3′ E, 299-320 m, 5 v. — Stn 51, 13°59.8′ N, 120°17′ E, 170-187 m, 5 v. — Stn 64, 14°00.8′ N, 120°18.6′ E, 191-195 m, 1 v. — Stn 68, 14°01.2′ N, 120°18.2′ E, 195-199 m, 4 v. — Stn 71, 14°00.6′ N, 120°18.5′ E, 189-197 m, 1 v. — Stn 72, 14°00.4′ N, 120°18.6′ E, 182-197 m, 1 v.

DISTRIBUTION. — Indo-Pacific, off East Africa, Maldives area, the Philippines, South and East China Sea to Honshu, Japan, in 136-1463 m.

DESCRIPTION. – *Shell* thick, rather small; umbones prominent. Outline variable but generally rounded-triangular. Inequilateral, post-umbonal part of shell short, truncate. Sculpture of numerous, nodulated or dorsally imbricated radial riblets, set closer on the posterior slope, which is set off by two shallow radial sulci. Primary riblets rather strong, with weaker intercalated riblets. Ligament opisthodetic, in a deep resilifer. Lithodesma strong, rectangular, with two short posterior lobes. *Right valve* with a sturdy cardinal tooth. *Left valve* with an anterior tubercle and a weak, remote posterior lateral tooth. Interior nacreous, with a radial ridge running from the umbonal cavity to the posteroventral margin. Inner shell margins crenulate. Length 19.2 mm.

Euciroa eburnea (Wood-Mason & Alcock, 1891)

Figs 23-24

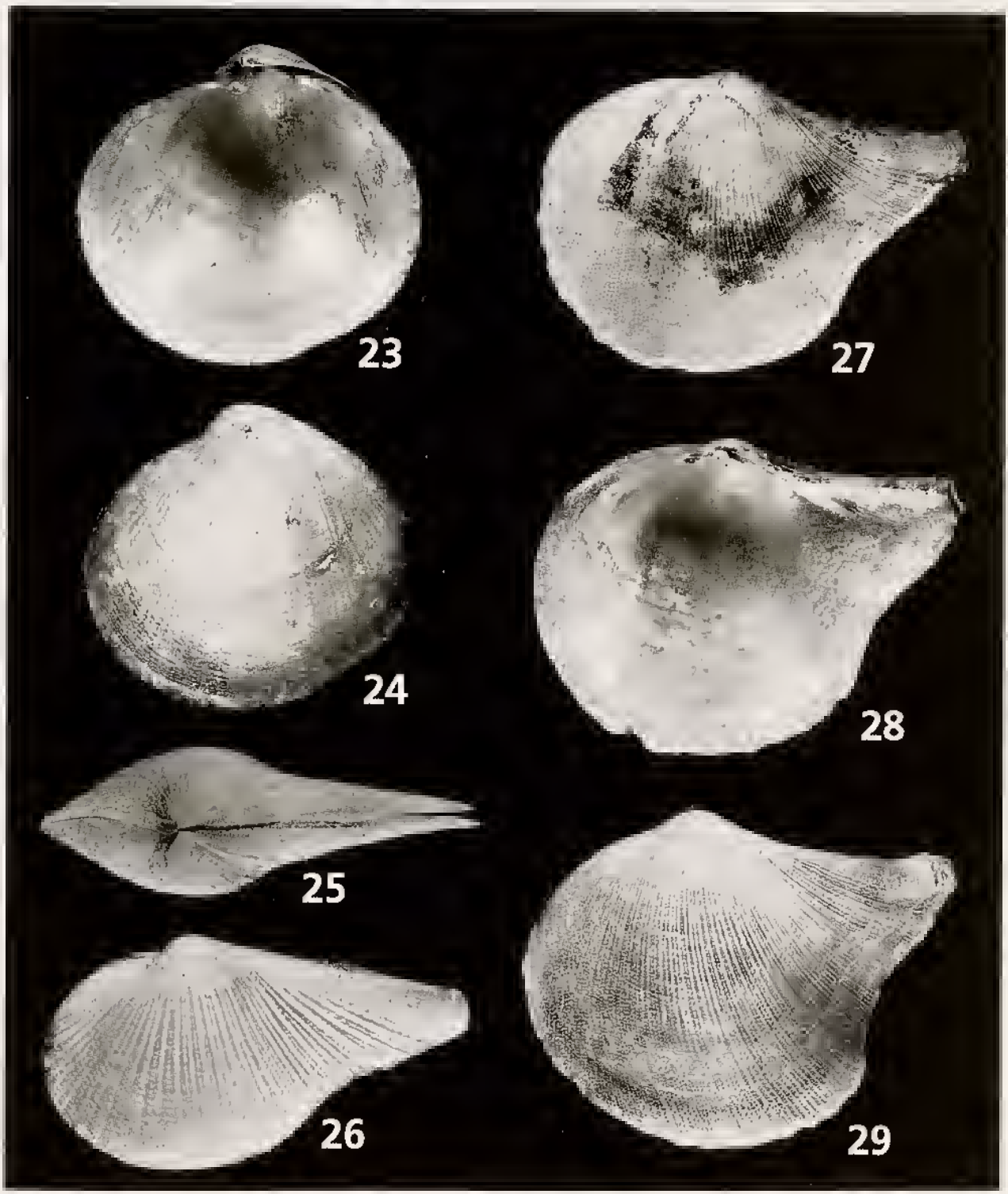
Verticordia (Euciroa) eburnea Wood-Mason & Alcock, 1891: 447, figs 14a-d.

Synonyms:

Verticordia optima G.B. Sowerby III, 1894a: 39, pl. 5, fig. 3; 1894b: 82.
Euciroa dalli Pilsbry, 1911: 523.

MATERIAL EXAMINED. – **Philippines**. MUSORSTOM 1: stn 44, 13°46.5′ N, 120°29.5′ E, 592-610 m, 1 db. — Stn 47, 13°41.5′ N, 120°30′ E, 685-757 m, 5 spms.

Source : MNHN, Paris



FIGS 23-29. — Euciroidae — **23-24**, *Euciroa eburnea*, MUSORSTOM 2: stn 79, L = 38.6 mm, interior of right valve (23), exterior of left valve (24). — **25-29**, *Acreuciroa rostrata*, MUSORSTOM 2: stn 75: **25-26**, L = 32.8 mm (juvenile specimen): dorsal view of shell (25), exterior of left valve (26); **27-28**, L = 61.4 mm (mature specimen): exterior of left valve (27), interior of right valve (28); **29**, L = 63.5 mm (gerontic form): exterior of left valve.

Source : MNHN, Paris

MUSORSTOM 2: stn 50, 13°37.4′ N, 120°33′ E, 810-820 m, 1 v. — Stn 79, 13°44′ N, 120°31.7′ E, 682-770 m, 3 spms, 1 db, 10 v. — Stn 82, 13°47′ N, 120°28.8′ E, 550 m, 1 spm.
New Caledonia. *"Vauban"* 1978-79: stn 15, 22°49′ S, 167°12′ E, 390-395 m, 1 v.

DISTRIBUTION. — Widely distributed in the Indo-Pacific region, from South Africa and the Gulf of Aden to the Philippines, the South China Sea and New Caledonia, in 340-1473 m.

DESCRIPTION. — *Shell* rounded-ovate, subequivalve, with umbones somewhat in front of midlength. Posterior slope set off by shallow radial sulcus. Sculpture of weak radial cords with rows of small spines and numerous microscopic nodules. Ligament opisthodetic, in a deep resilifer. Lithodesma long, slightly bifurcated. *Right valve* with a strong conical cardinal tooth, articulating in a pit of the opposite valve, and a shallow lateral ridge behind the resilifer. *Left valve* with anterior and posterior dorsal margins each produced in a tooth-like ridge, and with a small cardinal tooth edging the resilifer. Interior of shell brilliantly nacreous, with minute radial striae. Inner ventral margin finely crenulated. Length 38.6 mm.

Anatomy: Adductor muscles subequal. Mantle with large pedal opening, three-lobed, but lobes narrow. Ventral half of mantle much thickened. Taenioid muscles absent. Margins of pedal opening with minute erect spicules. Pallial apertures not developed into siphons, placed in a muscular plate, consisting of a small rounded exhalant aperture and a narrow fissure for the inhalant aperture. The apertures are surrounded by a row of simple conical tentacles. Foot laterally compressed, pointed, without a byssal groove. Gills appressed to the septum. Outer demibranch appearantly with ascending lamella only. Mouth broad, overhung by the lips that are produced into lateral bulbs, the "lateral sacs" of DALL (1895b). Ventrally is a tongue-like process, the "central posterior lappet" of DALL. A similar structure has been reported in *Lyonsiella formosa* by ALLEN & TURNER (1974) and is probably connected with adaptations to macrophagy. A similar appendage is also present in *Pholadomya candida* (MORTON, 1980). Labial palps long and prominent, similar to those of *Pholadomya* (MORTON, 1980). Oesophagus developed. Stomach large and globular. Two ducts to the digestive diverticula. Mid-gut and style-sac conjoined. Rectum probably penetrating the heart and passing over the posterior adductor muscle. Anus not projecting. Hermaphroditic, with superficial, arborescent testis.

REMARKS. — This species is closely related to *Euciroa pacifica* (Dall, 1895b) from Hawaii. The presence of some preserved specimens (MUSORSTOM 1: Stn 47) allowed the elucidation of the gross anatomy and comparison with DALL's (1895b) description of the Hawaiian species.

Euciroa eburnea shows a number of interesting similarities to the Verticordiidae and the Poromyidae. The presence of large labial palps separates it at family level. It shows a number of adaptations to macrophagy, but lacks any vestige of the "valvular membrane" associated with the inhalant siphon which can be extruded as a raptorial hood (MORTON, 1981b, 1985a, c). It is difficult to visualize how the minute inhalant fissure could be readily expanded, but the thickening of the mantle margins containing haemocoels and numerous muscle fibres may play a role. Mechanism of predation in *Euciroa* could be similar to the method supposedly used by verticordiids to capture bottom living preys (MORTON, 1987).

Euciroa millegemmata Kuroda & Habe, 1952

Figs 21-22

Euciroa millegemmata Kuroda & Habe *in* Kuroda, 1952: 14-15 (footnote 1 a), pl. 1, figs 12-15.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 19, 14°00.6′ N, 120°17.4′ E, 189-192 m, 1 spm. — Stn 32, 13°40.5′ N, 120°54′ E, 192-220 m, 1 spm.

DISTRIBUTION. — Limited to Western Pacific area, the Philippines and China Sea to Honshu, Japan, in 100-365 m.

DESCRIPTION. — *Shell* small, ovate, inflated. Inequivalve, right valve deeper. Anterior margin rounded, posterior margin slightly produced, obtusely angulate. Sculpture of numerous, fine narrow radial striae and rows of pustules or spines. Lunule deep, small. Ligament opisthodetic, in a deep resilifer. Lithodesma robust, with two pointed posterior lobes. *Right valve* with a small, conical cardinal tooth and a shallow posterior lateral ridge merged into shell margin; anterodorsal margin somewhat thickened internally. Dorsal margins of *left valve* slightly produced anteriorly and posteriorly. Interior of shell nacreous, with fine radial striae. Length 17.5 mm.

Source : MNHN, Paris

REMARKS. — This species has been placed without explanation in *Acreuciroa* by BERNARD *et al.* (1993).

Euciroa trapeza Poutiers, 1982

Figs 79-80

Euciroa trapeza Poutiers, 1982: 332-333, figs 1-2.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 14, 22°16' S, 167°17' E, 465-495 m, 6 v, fragments. — Stn 33, 22°33' S, 166°25' E, 290-350 m, 2 db (holotype). — Stn 34, 22°32' S, 166°26' E, 350-420 m, 4 v. — Stn 39, 22°29' S, 166°23' E, 375-550 m, 1db, 6 v. — Stn 40, 22°30' S, 166°24' E, 250-350 m, 7 v. All paratypes: AMS, MNHN, NMNZ, NSMT.

DISTRIBUTION. — West Pacific, off southern New Caledonia, in 250-550m.

DESCRIPTION. — *Shell* large, inflated, subequivalve, transversally elongated. Inequilateral, anterior margin broadly rounded, posterior margin rostrate, obtusely angulated and strongly sloping dorsally. Sculpture of thin radial threads fading out ventrally and posteriorly, and numerous irregular rows of small prickly granules. Ligament opisthodetic, in a deep resilifer. Lithodesma not known. *Right valve* with a strong conical cardinal tooth, articulating in a recess of the opposite valve, and a shallow lateral ridge behind the resilifer. *Left valve* with anterior and posterior dorsal margins each produced in a lateral ridge, and a weak tubercle in front of the resilifer. Interior of shell brilliantly nacreous, finely striated on margins. Length 58.0 mm.

Acreuciroa rostrata (Thiele & Jaeckel, 1931)

Figs 25-29

Euciroa (Acreuciroa) rostrata Thiele & Jaeckel, 1931: 249, pl. 10, figs 132-132a.

Synonym:

Euciroa (Acreuciroa) teramachii Kuroda, 1952: 15, figs 19-20.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 42, 13°54.5' N, 120°29' E, 379-407 m, 1 db. — Stn 43, 13°50' N, 120°28' E, 448-484 m, 1 db.
MUSORSTOM 2: stn 15, 13°55' N, 120°28.9' E, 326-330 m, 1 v. — Stn 75, 13°51.9' N, 120°30.1' E, 300-330 m, 4 spms, 4 db, 18 v. — Stn 78, 13°49.5' N, 120°28.5' E, 441-550 m, 2 v. — Stn 82, 13°47' N, 120°28.8' E, 550 m, 2 v. — Stn 83, 13°55.9' N, 120°30.5' E, 318-320 m, 4 v.

DISTRIBUTION. — From Indonesia to the Philippines, South and East China Sea to Honshu, Japan, in 200-550 m.

DESCRIPTION. — *Shell* large, rounded-ovate, with a well-developed posterior rostrum. Sculpture of numerous, spinose, intercalating radial riblets, tending to be more prominent towards the anterior end of rostrum. Ligament opisthodetic, broad, strong, heart-shaped. *Right valve* with a strong cardinal tooth and a posterior lateral lamina. *Left valve* edentate. Interior richly iridescent, finely striate on margins. Length 66.8 mm.

REMARKS. — The juveniles tend to be more elongate (POUTIERS, 1981; TSUCHIDA, 1986). Following HABE (1977, 1981) and ABBOTT & DANCE (1982), the posteriorly produced *Acreuciroa* is here considered a separate genus, distinct from the ovate and inflated species of *Euciroa s. s.*

Source : MNHN, Paris

Family CUSPIDARIIDAE

Cuspidaria convexa Pelseneer, 1911

Figs 30-31

Cuspidaria convexa Pelseneer, 1911: 80, pl. 26, fig. 10.

Other reference.

Cuspidaria (Cuspidaria) convexa — PRASHAD, 1932: 329, pl. 7, figs 36-37.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 5, 14°01.5′ N, 120°22′ E, 200-215 m, 1 spm.
MUSORSTOM 2: stn 49, 13°38.8′ N, 121°43.2′ E, 416-425 m, 1 db.

DISTRIBUTION. — Western Pacific area, East of Java, the Central Philippines and South China Sea, in 100-694 m.

DESCRIPTION. — *Shell* globular, thin and white, slightly inequivalve, with a deeper left valve. Umbones prominent, anteriorly situated; postumbonal part equals about 60% of shell length. Anterior side of valves rounded, posterior drawn out in a short, wide rostrum, poorly marked off from disc by shallow radial depression. Posterodorsal area of rostrum with a few indistinct radial threads. Sculpture of irregular concentric striae; surface with mucus-bound mud layer. Resilifer a narrow, opisthogyrate groove almost parallel to dorsal margin and not protruding under the hinge. *Right valve* with a trigonal, elongate, prominent posterior lateral tooth. *Left valve* edentate. Interior of shell milky white, glossy. Length 12.3 mm.

REMARKS. — This species is very similar to the Indian Ocean *C. approximata* E. A. Smith, 1896, but KNUDSEN (1967: 309) gave anatomical reasons to distinguish them. In *C. approximata*, the concentric sculpture is said to be thinner, the rostrum seems to be more ventrally placed and has a distinct ridge radiating from umbo to posteroventral end of shell. However, some of these characters may be mutable, and nothing is known about the individual variation of shell in the two species.

Cuspidaria convexa is compared by PRASHAD to his *C. mitis*, a less globular and more elongate species with less protruding umbones.

Cuspidaria corrugata Prashad, 1932

Figs 32-33

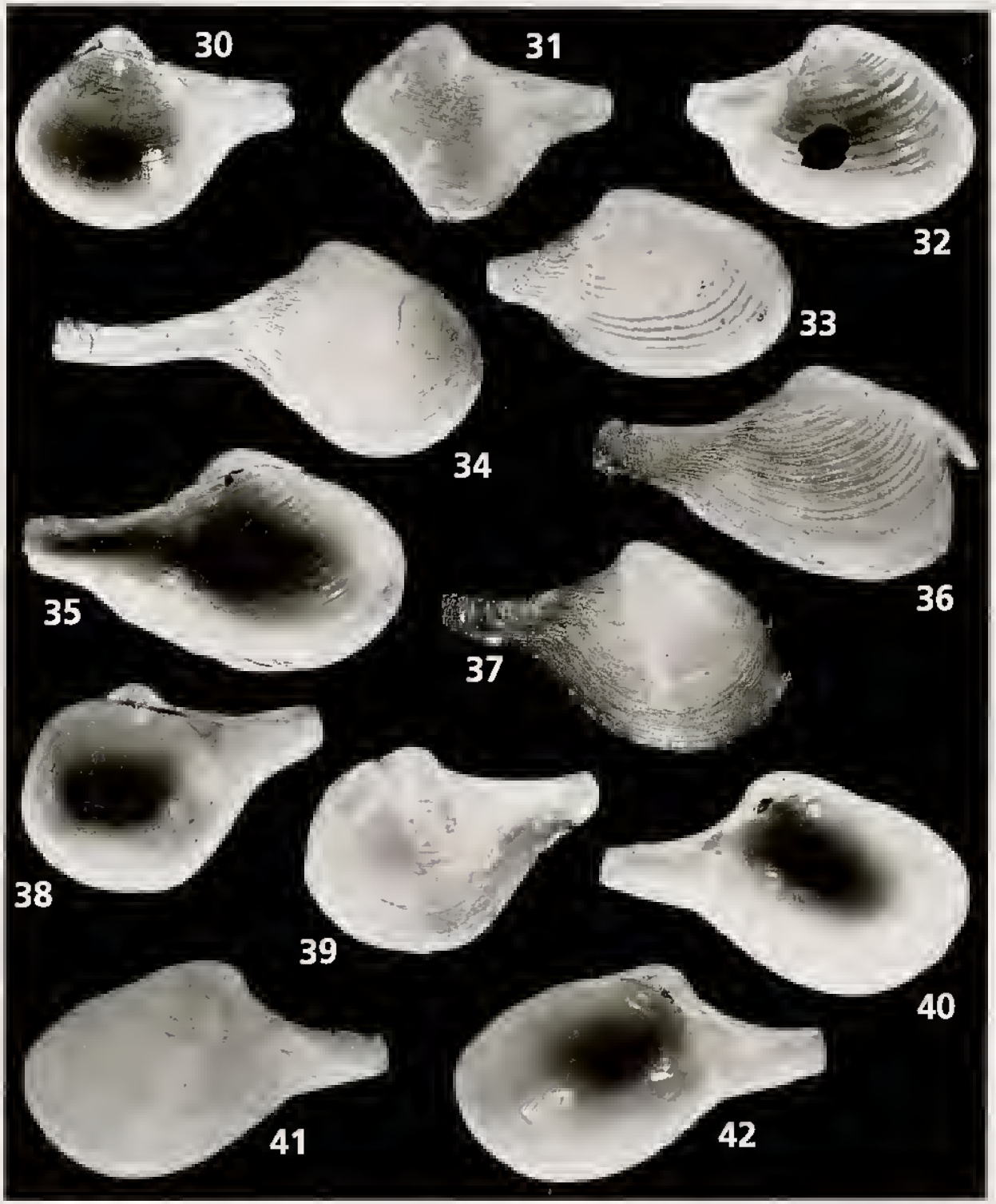
Cuspidaria (Cuspidaria) corrugata Prashad, 1932: 329, pl. 7, fig. 38.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 26, 13°49′ N, 120°50.3′ E, 299-320 m, 1 db. — Stn 72, 14°00.4′ N, 120°18.6′ E, 182-197 m, 1 v. — Stn 80, 13°45.2′ N, 120°37.5′ E, 178-205 m, 2 v.

DISTRIBUTION. — Western Pacific, Indonesia and the Philippines, in 38-320 m.

DESCRIPTION. — *Shell* thin, ovate, shortly rostrate posteriorly. Umbones not elevated, a little behind midlength of shell. Dorsal margin strongly sloping on either side of umbones. Ventral margin arcuate, curving up sharply in its posterior half. Rostrum short, subcentral, tapered, with a truncate end, set off by a broad radial depression that also produces a sinuous ventral margin. Sculpture of strong concentric riblets with wide interspaces, more regularly placed anteriorly, somewhat sinuous and lamellose posteriorly. Concentric riblets ending on rostrum along a strong oblique ridge radiating from umbones to the posteroventral margin. Posterodorsal area of rostrum crowded with very fine concentric threads, with a second, lower radial ridge bordering dorsal margin of shell. Internal ligament opisthogyrate, in a narrow, oblique resilifer that is not produced. *Left valve* edentate. Posterior denticle of *right valve* obsolete. Posterior adductor scar well impressed, roughly trigonal, bordered on umbonal margin by an internal reinforcement of shell. Anterior adductor scar indistinct. Inner surface with concentric undulations. Length 17.3 mm.

Source : MNHN, Paris



FIGS 30-42. — Cuspidariidae — **30-31**, *Cuspidaria convexa*, MUSORSTOM 2: stn 49, L = 12.3 mm, interior of right valve (30), exterior of left valve (31). — **32-33**, *Cuspidaria corrugata*, MUSORSTOM 2: stn 80, L = 16.5 mm, interior of left valve (32), L = 17.3 mm, exterior of right valve (33). — **34**, *Cuspidaria gigantea*, MUSORSTOM 2: stn 10, L = 33.7 mm, exterior of right valve. — **35-36**, *Cuspidaria hindsiana*, MUSORSTOM 1: stn 71, L = 22.0 mm, interior of left valve (35), exterior of right valve (36). — **37**, *Cuspidaria japonica*, MUSORSTOM 2: stn 11, L = 27.7 mm, exterior of right valve. — **38-39**, *Cuspidaria kyushuensis*, MUSORSTOM 2: stn 25, L = 12.7 mm, interior of right valve (38), exterior of left valve (39). — **40-42**, *Cuspidaria morrisae* sp. nov., *"Vauban"* 1978-79: stn 42, holotype, L = 20.0 mm, interior of left valve (40), exterior of left valve (41), interior of right valve (42).

Source : MNHN, Paris

REMARKS. — The present material agrees well with PRASHAD's original description, although his figure of the outside of shell shows a somewhat more centrally placed umbo and more irregular concentric sculpture. However, the shape of MUSORSTOM 2 valves is rather variable, and theses differences may represent individual variation. Prashad did not describe nor figure the hinge, stating only it is "as in typical *Cuspidaria*", but in the right valves described here, the posterior tooth is indistinct.

Cuspidaria gigantea Prashad, 1932

Fig. 34

Cuspidaria (Cuspidaria) gigantea Prashad, 1932: 329, pl. 7, fig. 38.

Synonym:

Cuspidaria kawamurai Kuroda, 1948: 11, pl. 1, fig. 4.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 71, 14°09.5′ N, 120°26.5′ E, 174-204 m, 1 spm.
MUSORSTOM 2: stn 10, 14°00.7′ N, 120°18.2′ E, 188-195 m, 1 v. — Stn 26, 13°49′ N, 120°50.3′ E, 299-320 m, 1 v. — Stn 51, 13°59.8′ N, 120°17′ E, 170-187 m, 2 v.

DISTRIBUTION. — Indo-Pacific, from Southeast Africa to the Philippines, South and East China Sea to Honshu, Japan, in 100-1030 m.

DESCRIPTION. — *Shell* solid, subequivalve, oblique ovate, strongly rostrate, very inequilateral. Umbones not prominent, feebly opisthogyrate. Rostrum long, narrow, usually recurved, set off from disc by a broad radial depression that deeply sinuates the ventral shell margin. Rostrum with an inflated ridge radiating from umbones to the posterodorsal margin, giving the appearance of an elongate escutcheon. Sculpture of a concentric striation, becoming coarse and irregular posteriorly in the depressed area of the posteroventral sinuation. Periostracum thick, dehiscent. Internal ligament reinforced by a lithodesma, in vertical trigonal resilifer that is strongly protruded under hinge margin. *Right valve* with a strong posterior lateral tooth. *Left valve* edentate. Interior of shell with fine radial striae. Length 33.7 mm.

REMARKS. — KNUDSEN (1967: 314) synonymized *Cuspidaria kawamurai* with *C. gigantea*, but used Kuroda's name on the basis that the specific name *gigantea* was preoccupied by VERRILL (1884). BARNARD (1964: 579) also mentioned this homonymy, but did not give any replacement name for *C. gigantea* Prashad. However, VERRILL's species was described under *Neaera*, and actually belongs to *Myonera* (VERRILL & BUSH, 1898). Thus, the secondary homonymy detected by BARNARD and KNUDSEN doesn't exist any more, and the specific name *C. gigantea* Prashad, 1932 remains.

Cuspidaria hindsiana (A. Adams, 1864)

Figs 35-36

Neaera hindsiana A. Adams, 1864: 207.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 71, 14°09.5′ N, 120°26.5′ E, 174-204 m, 1 spm.

DISTRIBUTION. — Northwestern Pacific, the Philippines, East China Sea to Taiwan and Honshu, Japan, in 50-200 m.

DESCRIPTION. — *Shell* thin and white, inflated, elongate-ovate, with a narrow central recurved rostrum. Ventral margin broadly convex, with a weak posterior constriction at base of rostrum. Sculpture of thin, irregular sharp concentric ridges, and many very fine growth lines. Rostrum with numerous transverse grooves and a few indistinct radial threads. Periostracum thin, adherent, translucent. Internal ligament with broad lithodesma, attached in each valve to a

Source : MNHN, Paris

trigonal resilifer that is inclined posteriorly. Hinge of *right valve* with a strong, elongate, trigonal posterior lateral tooth. *Left valve* edentate. Interior of shell with outer concentric ribbing showing through. Length 22.0 mm.

Cuspidaria japonica Kuroda, 1948

Fig. 37

Cuspidaria japonica Kuroda, 1948: 14, pl. 1, fig. 2.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 11, 14°00.3′ N, 120°19.3′ E, 194-196 m, 1 v. — Stn 68, 14°01.2′ N, 120°18.2′ E, 195-199 m, 1 db.

DISTRIBUTION. — Northwest Pacific, from the Philippines to Honshu, Japan, in 100-200 m.

DESCRIPTION. — *Shell* rather large, globose-ovate, with a moderately developed, attenuate dorsal rostrum. Umbones submedian, inflated but not very prominent, slightly opisthogyrate. Anterodorsal margin broadly convex, oblique. Anterior and ventral margins rounded, the latter somewhat sinuate posteriorly. Posterodorsal margin straightish to a little recurved, gently sloping. Base of rostrum relatively broad, with weak radial depression ending in the posteroventral sinuosity of margin. Sculpture of irregular concentric striae, becoming coarser on rostrum. Periostracum thin, adherent, beige in colour, somewhat darker and fibrous on ventral margin and rostrum. Internal ligament reinforced by a short lithodesma, in a small pit under and behind the umbo. Hinge of *right valve* with a short posterior lateral tooth and a small internal thickening of margin in front of umbo. *Left valve* edentate. Interior of shell milky white. Length 27.7 mm.

REMARKS. — This species is similar to *C. lubangensis* Poutiers, 1981, from the Central Philippines, but the latter has a proportionately shorter rostrum, and more delicate hinge in the right valve.

Cuspidaria kyushuensis Okutani, 1962

Figs 38-39

Cuspidaria kyushuensis Okutani, 1962: 35, pl. 3, fig. 12.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 25, 13°40′ N, 120°43′ E, 520-550 m, 1 db, 1 v.

DISTRIBUTION. — Northwest Pacific, from Kyushu, Japan, to the central Philippines, in 520-760 m.

DESCRIPTION. — *Shell* solid, globose, quadrangular-ovate, with a ventral enlargement and a rather short, compressed, slightly upturned rostrum. Inequivalve, left valve somewhat deeper and larger ventrally. Umbones small, inflated, anterior to midlength of shell. Sculpture of rather regular concentric lirae, disappearing on rostrum. Shell chalky white, with a feebly glowing olive-yellow periostracum. Internal ligament in a small, deep, oblique pit under umbo. *Right valve* with a stout, trigonal posterior lateral tooth and a thickened anterior hinge margin. Hinge of *left valve* edentate. Interior of shell whitish, porcelaneous. Posterior adductor scar trigonal, deeply impressed. Anterior adductor scar elongate-ovate, with a small pedal retractor scar near its posterodorsal end. Pallial line hardly distinct, with a large sinus at base of rostrum. Length 12.7 mm.

REMARKS. — The present material agrees well with the short diagnosis and figure of *C. kyushuensis* given by OKUTANI (1962). Although he compared it with *C. circinata* (Jeffreys, 1876), it seems more closely related to the Atlantic *C. ventricosa* Verrill & Bush, 1898. In the latter species, however, the sculpture is coarser and more closely spaced, and the posterior lateral tooth is closer to the ligament pit.

Source : MNHN, Paris

Cuspidaria lubangensis Poutiers, 1981

Fig. 83

Cuspidaria lubangensis Poutiers, 1981: 348. pl. 3, figs 4-5.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 63, 14°00.5′ N, 120°16′ E, 191-195 m (holotype db, MNHN).

DISTRIBUTION. — Only known from the central Philippines, in 191-195 m.

DESCRIPTION. — *Shell* brittle, globose-ovate, with a moderately developed and rather broad dorsal rostrum. Umbones inflated, on midlength of valves, nearly orthogyrate. Anterior and ventral margins rounded, the former subangulate dorsally, the latter somewhat sinuate posteriorly. Posterodorsal margin concave, dorsally recurved towards posterior end. Base of rostrum with a shallow radial depression ending in the posteroventral sinuosity of margin. Sculpture of irregular, concentric grooves and narrow wrinkles, the former more developed posteriorly. Periostracum beige to brown, adherent, fibrous, darker and coarser towards margins. Internal ligament fitting in an oblique resilifer that is slightly protruding under hinge margin. Hinge of *right valve* with a shallow posterior lateral tooth. *Left valve* edentate. Interior of shell bright white in colour. Length 19.5 mm.

REMARKS. — For comparison with *Cuspidaria japonica* Kuroda, 1948, see under that species.

Cuspidaria macrorhynchus E. A. Smith, 1895

Figs 43-44

Cuspidaria macrorhynchus E. A. Smith, 1895: 12. pl. 2, figs 5-5a.

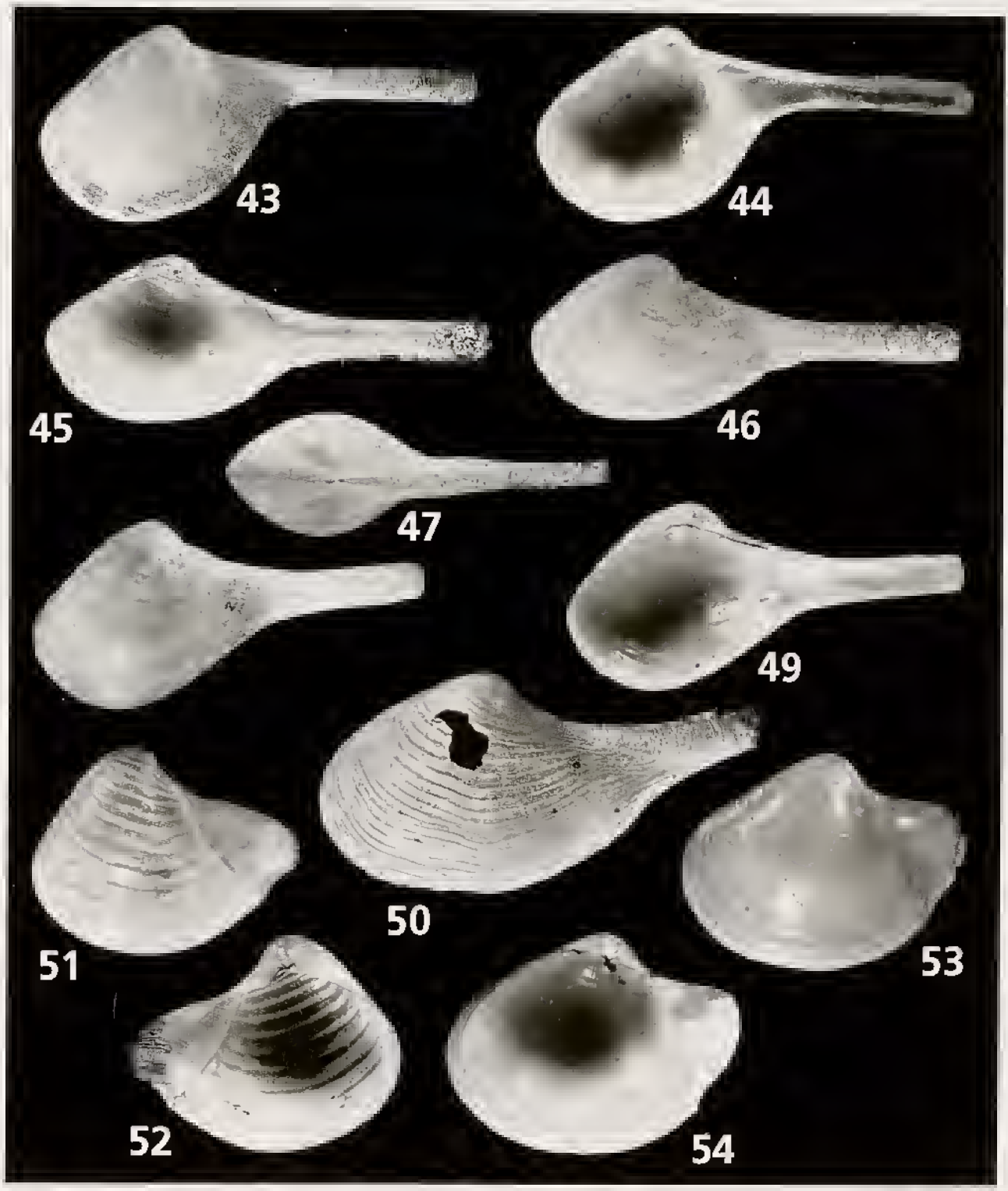
MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 39, 13°08′ N, 122°36.3′ E, 1030-1190 m, 8 v. — Stn 44, 13°23.5′ N, 122°20.6′ E, 760-820 m, 2 spms, 3 db.

DISTRIBUTION. — Indo-Pacific, from East Africa to Indonesia, the Philippines and China Sea, in 400-1190 m.

DESCRIPTION. — *Shell* thin, strongly inequilateral, ovate to slightly oblique with a very long and narrow, tube-like rostrum. Umbones prominent, in front of midlength of shell. Anterodorsal margin straight, horizontal, close to umbones, slightly convex and strongly sloping anteriorly. Anterior and ventral margins rounded, the latter deeply sinuate at base of rostrum. Posterodorsal margin straight, horizontal, sometimes slightly recurved distally. Sculpture of a fine irregular concentric striation, becoming coarser and transverse on posterodorsal area of rostrum. An obsolete diagonal ridge radiating from umbo to posteroventral extremity of rostrum. Periostracum thin, pale ochre in colour, becoming thicker and darker on periphery of disc and particularly on rostrum. Internal ligament with a short lithodesma, attached in each valve to a minute, oblique resilifer, rounded ventrally and pointing under umbo. *Right valve* with a prominent posterior lateral tooth and an anterior lateral groove for the opposite valve margin. *Left valve* edentate. Interior of shell glossy white, with a very fine radial striation and one or two shallow longitudinal ridges in dorsal half of rostrum. Length 36.2 mm.

REMARKS. — The shell of this species is somewhat variable, and the rostrum tends to be relatively longer with a slightly recurved tip on older specimens. *Cuspidaria sugamumai* Nomura, 1940, from Japan in 106-220 m, is usually synonymized with *C. macrorhynchus*, but has a shorter, proportionately wider rostrum and stronger dentition in the right valve. It is considered here as a valid species limited to Japan.

Source : MNHN, Paris



FIGS 43-54. — Cuspidariidae — **43-44**, *Cuspidaria macrorhynchus*, MUSORSTOM 2: stn 44, L = 23.7 mm, exterior of left valve (43), interior of right valve (44). — **45-47**, *Cuspidaria prolatissima*, MUSORSTOM 2: stn 80, L = 23.9 mm, interior of right valve (45), exterior of left valve (46); L = 21.0 mm, dorsal view of shell (47). — **48-49**, *Cuspidaria steindachneri*, MUSORSTOM 1: stn 63, L = 18.6 mm, exterior of left valve (48), interior of right valve (49). — **50**, *Myonera (Rengea) caduca*, *"Vauban"* 1978-79: stn 42, L = 30.5 mm, exterior of left valve. — **51-52**, *Myonera rostra* sp. nov., MUSORSTOM 2: stn 40, holotype, L = 13.4 mm, interior of left valve (51), exterior of left valve (52). — **53-54**, *Myonera dautzenbergi*, CORINDON: stn 280, L = 18.4 mm, exterior of left valve (53), interior of right valve (54).

Source : MNHN, Paris

Cuspidaria morrisae sp. nov.

Figs 40-42

TYPE MATERIAL. — Holotype db, MNHN.

TYPE LOCALITY. — New Caledonia. "*Vauban*" 1978-79, stn 42, 22°08′ S, 167°04′ E, 230-260 m.

MATERIAL EXAMINED. — Known only from the type material.

DISTRIBUTION. — Known only from the type locality.

DESCRIPTION. — *Shell* solid, inflated, oblique ovate, inequilateral. Anterior side rounded, posterior side with a short central rostrum, relatively narrow, abruptly truncate distally. Inequivalve, left valve slightly deeper and commissural plane somewhat distorted ventrally, a little drawn out to the left anteriorly and to the right posteriorly. Umbones prominent, opisthogyrate, well behind midlength of shell, the postumbonal part forming about 42% of the total length. Anterodorsal margin elongate, oblique, broadly arcuate, meeting rounded anterior margin at an obtuse angle. Posterodorsal margin concave, gently sloping. Ventral margin rounded, becoming sinuous and oblique posteriorly. Rostrum laterally compressed, set off from disc by a radial depression, with a rounded diagonal ridge running from umbo to the postero-ventral margin. Sculpture of numerous irregular concentric lines and grooves. Periostracum thin, translucent, yellow-ochre, stronger and folded ventrally. Internal ligament with broad, arched lithodesma, attached to a shallow oblique resilifer protruding a little beyond hinge margin. Hinge feeble. *Right valve* with an obscure posterior lateral tooth. *Left valve* edentate. Posterior adductor scar well impressed, kidney-shaped; anterior adductor scar indistinct. Interior of shell porcelaneous white, with fine radial striae.

Measurements: Length 20.0 mm, height 12.3 mm, inflation 9.8 mm. The single specimen consists of a set of valves in fresh condition.

REMARKS. — This new species can be compared to *C. capensis* (E. A. Smith, 1885) from the Southeast Atlantic, but the latter is rather more compressed, the umbones are less prominent, more anteriorly placed and not strongly opisthogyrate.

ETYMOLOGY. — The specific name is for Dr S. MORRIS formerly of the British Museum (Natural History) in recognition of abundant and cheerful assistance.

Cuspidaria nobilis (A. Adams, 1864)

Fig. 61

Neaera nobilis A. Adams, 1864: 207.

Synomym:

Cuspidaria nobilis consimilis Habe, 1961: 146 & App. 42, pl. 65, fig. 21.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 19, 14°00.6′ N, 120°17.4′ E, 189-192 m, 1 db. — Stn 21, 14°01.2′ N, 120°17.6′ E, 191-192 m, 1 v. — Stn 51, 13°59.8′ N, 120°17′ E, 170-187 m, 2 v. — Stn 59, 14°00.4′ N, 120°17′ E, 186-190 m, 1 v. — Stn 68, 14°01.2′ N, 120°18.2′ E, 195-199 m, 1 spm, 7 v. — Stn 71, 14°00.6′ N, 120°18.5′ E, 189-197 m, 1 v. — Stn 80, 13°45.2′ N, 120°37.5′ E, 178-205 m, 2 v.
Indonesia. CORINDON: stn 267, 1°56.6′ S, 119°16.7′ E. 134-186 m, 1 spm.

DISTRIBUTION. — Western Pacific, Indonesia, the Philippines, East China Sea to Honshu and Shikoku, Japan, in 50-300 m.

DESCRIPTION. — *Shell* large, inflated, inequilateral, elongate-ovate, with an attenuate, rostrate posterior end. Umbones inclined posteriorly, situated a little in front of midlength of shell. Anterodorsal margin convex, meeting without discontinuity the rounded anterior margin. Rostrum large, ventral, truncate, with a weak angle radiating to posteroventral corner. Posterodorsal margin strongly recurved. Ventral margin arcuate, a little sinuate posteriorly by a

Source : MNHN, Paris

faint radial groove at base of rostrum. Sculpture of many strong concentric ribs. Surface white, periostracum thin and yellowish, often becoming stronger and darker on rostrum. Resilifer broad, subvertical. *Right valve* with a low, triangular posterior lateral tooth. *Left valve* edentate. Inner face of shell undulated by the outer concentric sculpture. Length 51.7 mm.

Cuspidaria prolatissima Poutiers, 1981

Figs 45-47

Cuspidaria prolatissima Poutiers, 1981: 348, pl. 3, figs 2-3.

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 1: stn 25, 14°02.5' N, 120°22' E, 191-200 m, 1 spm. — Stn 31, 14°00' N, 120°17.5' E, 187-195 m, 1 spm. — Stn 42, 13°54.5' N, 120°29' E, 379-407 m, 2 spms (holotype and paratype).
MUSORSTOM 2: stn 17, 14°00.5' N, 120°17.8' E, 174-193 m, 1 spm. — Stn 21, 14°01.2' N, 120°17.6' E, 191-192 m, 2 spms. — Stn 26, 13°49' N, 120°50.3' E, 299-320 m, 1 spm. — Stn 51, 13°59.8' N, 120°17' E, 170-187 m, 1 v. — Stn 63, 14°07.3' N, 120°15.5' E, 215-230 m, 1 spm. — Stn 64, 14°00.8' N, 120°18.6' E, 191-195 m, 1 spm, 3 v. — Stn 68, 14°01.2' N, 120°18.2' E, 195-199 m, 2 spms. — Stn 80, 13°45.2' N, 120°37.5' E, 178-205 m, 2 spms, 1 v. — Stn 83, 13°55.9' N, 120°30.5' E, 318-320 m, 1 spm, 2 v.

DISTRIBUTION. — Fairly common in the central Philippines, in 170-407 m.

DESCRIPTION. — *Shell* equivalve, moderately inflated, elongate-ovate, with a long, narrow, straight rostrum, sometimes a little upturned posteriorly. Anterodorsal slope strongly depressed, set off by an oblique radial fold forming an angle at anterior end. Sculpture of numerous irregular concentric striae, becoming coarser and transverse on rostrum, and overlain by shallow concentric ribs on umbonal and anterior parts of the disc. Rostrum demarcated by a radial sulcus, with a smoothish dorsal margin and an umbonoventral ridge becoming indistinct posteriorly. Internal ligament in a small trigonal socket beneath and behind the umbo. Hinge plate narrow. *Right valve* with an elongate posterior lateral tooth. *Left valve* edentate. Length 26.7 mm.

REMARKS. — This elongate species is distinguished by the infolded area anterior to the umbo, rather like a large lunule, and the consequently acute anterior shell margin.

Cuspidaria steindachneri Sturany, 1901

Figs 48-49

Cuspidaria steindachneri Sturany, 1901: 261, pl. 1, figs 5-9.

Synonym:
Cuspidaria hirasei Kuroda, 1948: 10, pl. 1, fig. 3.

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 1: stn 63, 14°00.5' N, 120°16' E, 191-195 m, 1 db.

DISTRIBUTION. — Indo-Pacific, Red Sea, Indian Ocean, the Philippines, South China Sea to Honshu, Japan, in 106-1308 m.

DESCRIPTION. — *Shell* solid, elongate-ovate, with a long, straight central rostrum. Umbones prominent, well anterior to midlength of shell. Anterodorsal margin oblique, slightly convex; posterodorsal margin concave. Ventral margin broadly rounded, with a posterior sinuation. Rostrum demarcated from disc by a shallow radial furrow. A fine ridge running from umbo to postcroventral extremity of rostrum, and becoming indistinct distally. Sculpture of irregular concentric striae, coarser and recurved at a right angle on posterodorsal area of rostrum. Internal ligament in a narrow, oblique resilifer. *Right valve* with a strong posterior lateral tooth and a distinct internal thickening of the anterodorsal margin. *Left valve* edentate, hinge margin somewhat prominent anterior to umbo. Interior of shell with fine radial lines. Length 18.6 mm.

Source : MNHN, Paris

Cuspidaria (Soyomya) clathrata sp. nov.

Figs 62-65

TYPE MATERIAL. — Holotype paired valves with dried soft parts, MNHN.

TYPE LOCALITY. — New Caledonia, *"Vauban"* 1978-79, stn 42, 22°08' S, 167°04' E, 230-260 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* solid, ovate, laterally compressed, slightly inequivalve; posterior end with a short rostrum. Umbones not very prominent, slightly prosogyrate and submedian, the postumbonal part forming about 51% of shell length. Anterodorsal margin horizontal just anterior to umbones, gently convex and sloping towards rounded anterior margin. Posterodorsal margin oblique, straight, subtruncate posteriorly. Posterior truncation a little stronger on right valve. Ventral margin broadly rounded, somewhat flattened posteriorly. Rostrum broad, laterally compressed, largely merged with disc, set off only by a shallow radial depression that becomes less prominent ventrally. Surface with irregular feeble concentric lirae and oblique rows of shallow pustules in a divaricate pattern. Pustules developed on main part of the disc, disappearing towards anterodorsal margin and on umbonal and rostral regions. Periostracum thin, adherent, translucent. Internal ligament light tan in colour, reinforced ventrally by a broad, subquadrate lithodesma, attached in each valve to a trigonal, posteriorly directed resilifer. Hinge of *right valve* with a strong, oblique posterior lateral tooth and a very small lamina just in front of resilifer. *Left valve* edentate. Inner side of shell shiny, milky white, with a shallow thickening in front of the posterior adductor scar and a number of thin unequal lines radiating from the umbonal cavity.

Measurements: Length 17.4 mm, height 12.5 mm, inflation 8.7 mm.

REMARKS. — The external oblique sculpture of the new species, recalling somewhat that of a *Strigilla* Turton, 1822, is highly distinctive and warrants separation of the taxon at the subgeneric level. It is here tentatively assigned to *Soyomya* Okutani, 1985, and is similar to *C. kurohijii* Okutani, 1972, from Japan, which is a more inflated species (inflation/length ratio 0.60-0.63, instead of 0.50 in *C. clathrata*), with more protruding umbones and a continuous sculpture resulting in a divaricate appearance.

ETYMOLOGY. — The specific name is derived from the Latin *clathratus*, latticed, with reference to the highly distinct sculpture.

Halonympha leiomyoides (Poutiers, 1981)

Figs 84-87

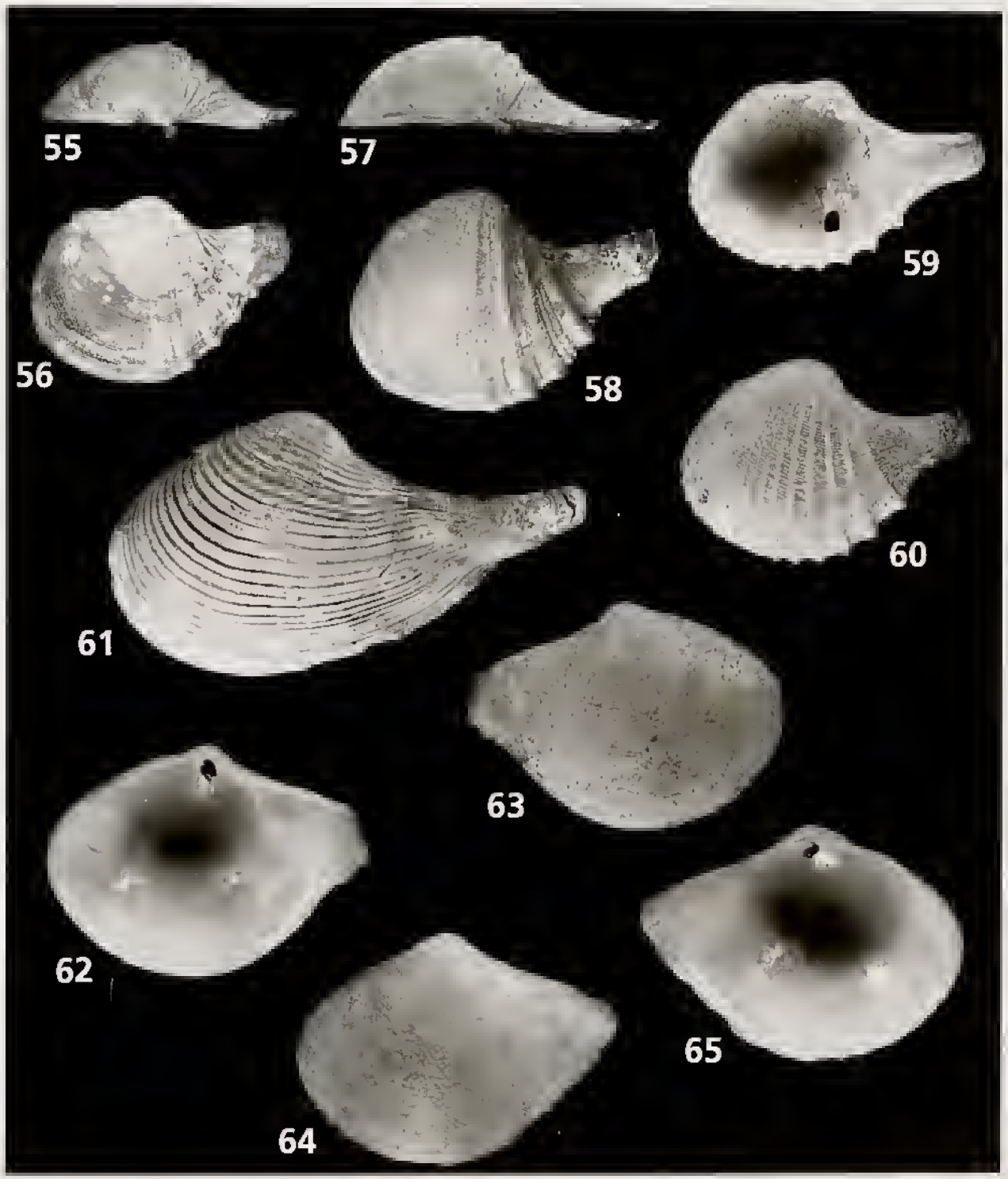
Cuspidaria leiomyoides Poutiers, 1981: 349-350, pl. 3, figs 6-7.

MATERIAL EXAMINED. — **Philippines**, MUSORSTOM 1: stn 50, 13°49' N, 120°02' E, 415-510 m, 1 db (holotype), 1 v (paratype) (MNHN).

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* globular, thin and translucent, whitish, equivalve. Inequilateral, rounded anteriorly and drawn out posteriorly in a short, trigonal blunt rostrum. Sculpture of low concentric ridges that are more densely set ventrally and fading out on posterior half of valves. Periostracum translucent and iridescent. Internal ligament fitting in each valve in an oblique, ventrally protruding resilifer. *Right valve* with a posteriorly recurved anterior cardinal tooth, bordered on anterior and posterior dorsal margins by a faint lateral ridge. *Left valve* with a small pointed posterior lateral tooth. A raised oblique ridge under posterodorsal margin of each valve. Interior of shell shiny, with an irregular tiny granulation. Length 9.0 mm.

Source : MNHN, Paris



FIGS 55-65. — Cuspidariidae — **55-56**, *Cardiomya (Kurodamya) fortisculpta*, Tosa Bay, Japan (MNHN, Coll. Staadt 1969), L = 13.1 mm, dorsal view of right valve (55), exterior of left valve (56). — **57-58**, *Cardiomya alcocki*, MUSORSTOM 2: stn 25, L = 18.2 mm, dorsal view of right valve (57), exterior of left valve (58). - **59-60**, *Cardiomya gouldiana*, MUSORSTOM 1: stn 58, L = 14.0 mm, interior of right valve (59), exterior of left valve (60). — **61**, *Cuspidaria nobilis*, MUSORSTOM 2: stn 71, L = 51.7 mm, exterior of left valve. — **62-65**, *Cuspidaria (Soyomya) clathrata* sp. nov., *"Vauban"* 1978-79: stn 42, holotype, L = 17.4 mm, interior of right valve (62), exterior of right valve (63), exterior of left valve (64), interior of left valve (65).

Source : MNHN, Paris

Cardiomya alcocki (E. A. Smith, 1894)

Figs 57-58

Cuspidaria alcocki E. A. Smith, 1894: 170, pl. 5, fig. 8.

Synonyms:

Cuspidaria (Cardiomya) potti Sturany, 1901: 264, pl. 1, figs 10-16.
Cuspidaria (Cardiomya) persculpta Prashad, 1932: 332, pl. 7, fig. 44.
Cuspidaria (Cardiomya) multicarinata Prashad, 1932: 332, pl. 7, figs 45-46.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 25, 13°39.5′ N, 120°42.9′ E, 520-550 m, 1 db.
Indonesia. CORINDON: stn 281, 1°59′ S, 119°09.9′ E, 715-800 m, 1 db.

DISTRIBUTION. — Indo-Pacific, Red Sea, northern Indian Ocean and Southeast Asia, in 60-1150 m.

DESCRIPTION. — *Shell* thin, fragile, ovate, inflated, subequivalve; left valve slightly larger, more inflated than right. Rostrum short, recurved, with obscure radial riblets. Sculpture of disc with radial riblets increasing in number towards ventral margin, and a few strong radial ribs on posterior slope. Concentric ornamentation of numerous fine lirae. Resilifer narrow, subvertical. *Right valve* with a strong elongate posterior lateral tooth. Interior with main external ribbing showing through. Length 22.5 mm.

REMARKS. — *Cardiomya alcocki* is usually considered a rather variable species and exhibits a somewhat discrepant radial sculpture on the disc. KNUDSEN (1967), following MELVILL & STANDEN'S (1907) suggestion, synonymized the Red Sea species *C. potti* under Smith's name. HABE (1964, 1977, 1981) merged with *C. alcocki* the Japanese *C. fortisculpta* (Kuroda, 1948) and the Southeast Asian *C. persculpta*, *C. multicarinata* and *C. semicostata* (all of Prashad, 1932). However, *C. fortisculpta*, erected as the type of subgenus *Kurodamya* by OKUTANI & SAKURAI (1964: 25), can be considered a valid species restricted to Japan. It is easily distinguishable from the above-mentioned forms by its sculpture being completely devoid of radial elements on the anterior slope, and by its especially short, strongly protruding posterior lateral tooth in the right valve. A specimen from Tosa Bay (Shikoku) is figured here for comparison (Figs 55-56). Following OKUTANI & SAKURAI (1964: 26), *C. semicostata* is a distinct species also referable to *Kurodamya*; it is characterized by its very short rostrum and radial sculpture restricted to the posterior third of shell.

Cardiomya gouldiana (Hinds, 1843)

Figs 59-60

Neaera gouldiana Hinds, 1843: 77.

Synonyms:

Cuspidaria (Cardiomya) gouldiana septentrionalis Kuroda, 1948: 18, pl. 2, fig. 12.
Cardiomya lindbergi Scarlato, 1972: 125, figs 14-16.
Cardiomya lindbergi batialis Scarlato, 1972: 126, figs 17-19.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 58, 13°58.5′ N, 120°14′ E, 143-178 m, 1 db.

DISTRIBUTION. — Indonesia, the Philippines, South China Sea, Yellow Sea and Japan Sea, in 13-1030 m.

Source : MNHN, Paris

DESCRIPTION. — *Shell* small, obliquely ovate, inequivalve; left valve somewhat larger, more inflated. Rostrum rather short, central, slightly recurved, with concentric lirae. Sculpture of a dozen or more strong, sharp radial ribs, slightly more developed in the right valve. Interspaces of ribs with regular concentric lirae. Resilifer small. *Right valve* with a strong, triangular posterior lateral tooth. Length 14.0 mm.

REMARKS. — This species is similar to *C. singaporensis* (Hinds, 1843) but is proportionately thinner, with less tumid umbones and more delicate radial ridges.

Myonera dautzenbergi Prashad, 1932

Figs 53-54

Myonera dautzenbergi Prashad, 1932: 334, pl. 7, fig. 51.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 81, 13°35.3′ N, 121° 01.3′ E, 856-884 m, 4 spms.
Indonesia. CORINDON: stn 280, 1°59′ S, 119°09.9′ E, 715-800 m, 4 spms, 3 db, 3 v.

DISTRIBUTION. — Indo-Pacific, from southern Indonesia to the Philippines and Japan (OKUTANI, 1968, 1976), in 715-959 m.

DESCRIPTION. — *Shell* relatively large, thin, inflated ovate, inequilateral. Left valve slightly larger, deeper, overlapping right along ventral margin. Umbones prominent, incurved, pointing behind midlength of shell. Anterior margin rounded. Rostrum broad, short, slightly recurved dorsally, compressed, set off from disc by a well-marked radial fold. Sculpture of numerous fine concentric striae, some raised in low undulations anteriorly. Surface of rostrum quite smooth. Periostracum adherent, straw-coloured, somewhat thickened towards margins, wrinkled on posterior end. Internal ligament oblique, with a thin lithodesma. Resilifer narrow, posteriorly directed. Interior of valves milky white, with the external sculpture showing through. Length 20.8 mm.

REMARKS. — This species has a somewhat variable outline and shows a slight allometry of growth, the height/length ratio tending to increase in large specimens.

Contrary to HABE's opinion (1981: 193, 195), *Myonera dautzenbergi* is not identical with *M. dispar* (Dall, Bartsch & Rehder, 1938), which has two radiating keels between the rostrum and the disc, and strong concentric undulations extending over the whole disc. Rather curiously, BERNARD *et al.* (1993: 118-119) repeated HABE's error and recorded *M. dautzenbergi* under two different generic names (namely *Cuspidaria* and *Myonera*). They also gave different synonymic and biogeographical data for these two denominations of the same species.

Myonera rostra sp. nov.

Figs 51-52

TYPE MATERIAL. — Holotype left valve, MNHN.

TYPE LOCALITY. — Philippines. MUSORSTOM 2, stn 40, 13°08′ N, 122°40.2′ E, 280-440 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* extremely thin, inflated, triangular, inequilateral, the postumbonal part forming about 60% of total length. Umbo large, rounded, prominent. Anterodorsal margin slightly convex, abruptly sloping towards the rounded anterior margin. Posterodorsal margin oblique, somewhat flexuous. Ventral margin broadly convex, with a slight sinuosity on its rostral side. Rostrum broad, compressed, wedge-shaped, rounded posteriorly. Rostrum set off from disc by a strong, narrow radial ridge. Sculpture of the disc of strong, distant concentric ribs, fading out towards the

Source : MNHN, Paris

anterodorsal margin and extending posteriorly to the umbonoventral ridge. Rostrum with a wide sulcus bordering the radial ridge, well marked towards the umbo, shallower near ventral margin. Surface of shell polished, with many fine concentric lines, translucent white under an adherent, straw-coloured periostracum. Hinge edentate, thin shelled, slightly upturned under the umbo, with a well-developed ligament in a long, narrow, oblique furrow. Interior of shell glossy, with the external sculpture showing through. Muscle scars indistinct. Margins smooth, apart from the shallow flexure on ventral side of rostrum.

Measurements: Length 13.4 mm; height 10.9 mm; inflation (one valve) 4.8 mm. The single specimen consisted of a set of valves with remains of soft parts. The right valve was fragmented according to F. R. Bernard and has been subsequently lost, so that the description and measurements are based only on the remaining left valve.

REMARKS. — This new species is very similar to *M. garretti* Dall, 1908, and *M. mexicana* Knudsen, 1970, two closely related eastern Pacific species. However, both American species are devoid of the radial furrow bordering the umbonoventral ridge of rostrum and are less inequilateral. *Myonera mexicana* is also more elongate, with a height/length ratio of 0.70 (*fide* KNUDSEN, 1970: 135) instead of 0.81 in the present species. In *M. garretti*, the concentric ribs do not reach the umbonoventral ridge, are indistinct on the central part of the disc (as shown in BERNARD, 1974: pl.19 fig.1) and less numerous for a same shell length, whereas in *M. rostra* they are continuous and more numerous (about 24 in number instead of 15 in *M. garretti*).

Myonera rostra bears a general resemblance to *Cuspidaria undata* (Verrill, 1884) of the Atlantic and Indian oceans. However, the latter is easily distinguishable by a more rounded outline, hinge teeth on right valve (KNUDSEN, 1970: 137; POUTIERS, 1984: 288) and the absence of radial ridge between rostrum and disc.

The shell erroneously figured by HABE (1981: pl. 8, fig. 4) as *M. dautzenbergi* is in fact another species identical or very similar to *M. rostra*.

ETYMOLOGY. — The specific name alludes to the well-developed rostral side of the shell.

Myonera (Rengea) caduca (E. A. Smith, 1894)

Fig. 50

Cuspidaria (Myonera) caduca E. A. Smith, 1894: 170, pl. 5, figs 9-10.

Synonym:

Myonera fluctuosa Kuroda, 1948: 25, pl. 2, fig. 20.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 42, 22°08' S, 167°04' E, 230-260 m, 1 v.

DISTRIBUTION. — Indo-Pacific, from Southeast Africa to New Caledonia and South China Sea to Honshu, Japan, in 50-1134 m.

DESCRIPTION. — *Shell* thin, white, inequilateral, elongate-ovate, with a long, broad, ventral, laterally compressed rostrum. Umbones not prominent, posteriorly inclined, in front of midlength of shell. Anterodorsal margin rounded, posterodorsal margin recurved. Ventral margin broadly arcuated, slightly sinuate posteriorly. Rostrum with two fine ridges diverging from umbo to the truncate posterior end of shell. Sculpture of irregularly concentric ridges and lirae. Resilifer subvertical, protruding under umbo. Hinge feeble, edentate. Outer concentric wavy sculpture visible from the inner side of shell. Length 30.5 mm.

REMARKS. — BERNARD *et al.* (1993: 118-119) erroneously recorded *Myonera caduca* twice in their catalogue of the living marine bivalves of China; once under *Cuspidaria* and once under *Rengea*. Under these two denominations of the same species, they provided different bathymetric, substrate, and geographic distributional data.

Source : MNHN, Paris

Family POROMYIDAE

Poromya (Cetomya) butoni (Prashad, 1932)

Figs 77-78

Poromya (Cetoconcha) butoni Prashad, 1932: 327, pl. 7, figs 33-34.

MATERIAL EXAMINED. — **Philippines**, MUSORSTOM 1: stn 26, 14°00′ N, 120°17′ E, 189 m, 1 spm. — Stn 31, 14°00′ N, 120°17.5′ E, 187-195 m, 1 db. — Stn 34, 13°59.5′ N, 120° 17.5′ E, 188-191 m, 1 db. — Stn 61, 14°01′ N, 120°17.5′ E, 124-129 m, 1 db. — Stn 72, 14°12.5′ N, 120°29′ E, 122-127 m, 1 spm. — Stn 73, 14°16′ N 120°31.5′ E, 70-76 m, 1 db.
MUSORSTOM 2: stn 19, 14°00.6′ N, 120°17.4′ E, 189-192 m, 1 spm, 1 db. — Stn 26, 13°49′ N, 120°50.3′ E, 299-320 m, 1 db. — Stn 59, 14°00.4′ N, 120°17′ E, 186-190 m, 1 spm. — Stn 72, 14°00.4′ N, 120°18.6′ E, 182-197 m, 1 v.

DISTRIBUTION. — Western Pacific, Indonesia and the Philippines, in 70-535 m.

DESCRIPTION. — *Shell* rather small, whitish to hyaline, inequilateral, slightly rostrate, subtruncate posteriorly. Inequivalve, right valve somewhat overlapping left at margins. Umbones prominent, situated in front of midlength of shell. Surface iridescent, sculpture of many rows of minute granules, mostly retained on shell periphery. Ligament mainly external, stretching along posterodorsal margin. Hinge feeble, a little strengthened under umbones, completely edentate in both valves. Interior glossy, with faint concentric growth undulations. Length 13.0 mm.

REMARKS. — *Poromya butoni* is completely edentate and has no trace of a cardinal tooth in right valve. The observation [by J.-M. P.] of the soft parts of a preserved specimen in MNHN (MUSORSTOM 1: stn 26) has shown that, in this species, the septum has two pairs of ostial openings. Then, *P. butoni* is not a *Cetoconcha* and instead belongs in the subgenus *Cetomya*. This doesn't bring *P. (Cetomya) butoni* in secondary homonymy with *P. (Dermatomya) buttoni* (Dall, 1916b) under Article 58 of the Code of Nomenclature (dealing with single or double consonants), because the two names are evidently not of the same origin and meaning: the epithet *butoni* is derived from Buton Strait, Banda Sea (the type locality of Prashad's species); the eastern Pacific *buttoni*, is named in honour of Mr Fred. L. BUTTON, as indicated by DALL (1900a: 321; 1916a: 5, 22). Thus, Article 57f is applicable, and the two names are not homonyms.

Poromya (Cetomya) eximia (Pelseneer, 1911)

Figs 74-75

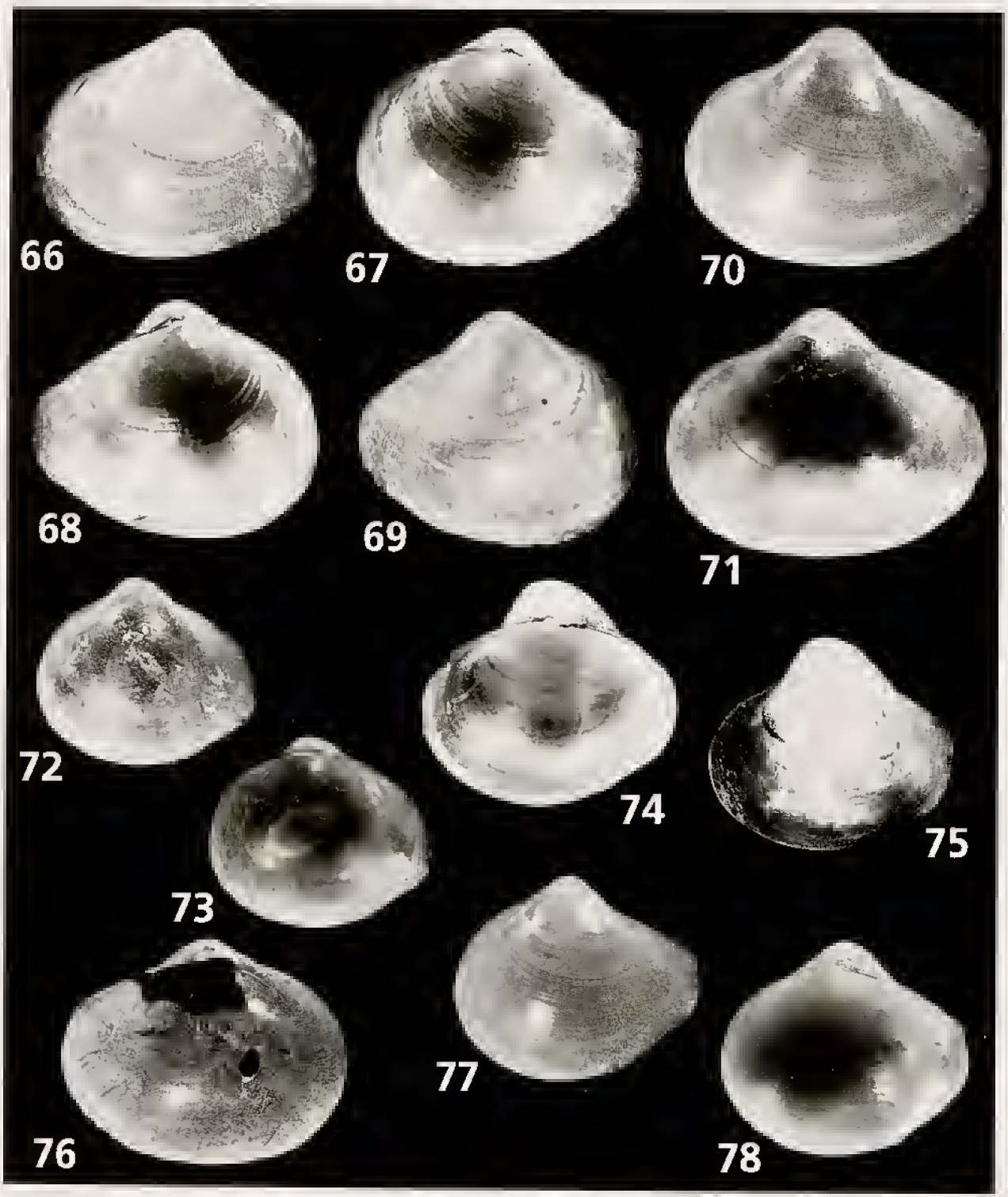
Poromya eximia Pelseneer, 1911: 78, pl. 26, figs 3-4.

Others references:

Poromya (Cetoconcha) eximia — PRASHAD, 1932: 327, pl. 7, figs 31-32.
Cetoconcha (*eximia* var?) *intermedia* — HABE, 1952b: 158, pl. 21, figs 18-19.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 50, 13°49′ N, 120°02′ E, 415-510 m, 1 v.
MUSORSTOM 2: stn 25, 13°39.5′ N, 120°42.9′ E, 520-550 m, 3 spms. — Stn 39, 13°08′ N, 122°36.3′ E, 1030-1190 m, 1 spm. — Stn 44, 13°23.5′ N, 122°20.6′ E, 760-820 m, 1 db, 2 v. — Stn 46, 13°26.2′ N, 122°17.3′ E, 445-520 m, 1 db. — Stn 75, 13°51.9′ N, 120°30.1′ E, 300-330 m, 1 v. — Stn 78, 13°49.5′ N, 120°28.5′ E, 441-550 m, 2 spms. — Stn 82, 13°47′ N, 120°28.8′ E, 550 m, 1 v.

Source : MNHN, Paris



FIGS 66-78. — Poromyidae — **66-69**, *Cetoconcha boucheti* sp. nov., MUSORSTOM 2: stn 75, holotype, L = 17.7 mm, exterior of left valve (66), interior of right valve (67), interior of left valve (68), exterior of right valve (69). — **70-71**, *Cetoconcha gloriosa*, CORINDON: stn 208, L = 21.1 mm, exterior of left valve (70), interior of right valve (71). — **72-73**, *Cetoconcha exigua* sp. nov., MUSORSTOM 2: stn 56, holotype, L = 6.0 mm, exterior of left valve (72), interior of right valve (73). — **74-75**, *Poromya (Cetomya) eximia*, MUSORSTOM 2: stn 25, L = 15.4 mm, interior of right valve (74), exterior of left valve (75). — **76**, *Cetoconcha japonica*, "*Vauban*" 1978-79: stn 9, L = 7.9 mm, exterior of right valve. — **77-78**, *Poromya (Cetomya) butoni*, MUSORSTOM 1: stn 26, L = 11.0 mm, exterior of left valve (77), interior of right valve (78).

Source : MNHN, Paris

DISTRIBUTION. — Indo-Pacific, off East Africa, Flores Sea, the Philippines and South China Sea to Honshu, Japan, in 300-1190 m. *Poromya intermedia* (Habe, 1952) is said to be a local form of this species, living in Japan in 50-200 m.

DESCRIPTION. — *Shell* inequilateral, highly inflated, rhomboidal-ovate, with a short, broad posterior rostration. Right valve slightly overlapping left along ventral and posterodorsal margins. Umbones much inflated, prominent, strongly incurved, prosogyrate. Posterior side laterally compressed, with a shallow, indistinct depression radiating from umbo to posteroventral margin, where it appears as a faint sinus. A small ridge, more distinct on the right valve, extending along posterodorsal margin. Sculpture of concentric growth lines and striae, and easily eroded radial rows of granules, most developed posteriorly. Shell whitish under a pale dull brown periostracum, becoming irregularly wrinkled posteroventrally. Ligament short, visible from the outside. Hinge margin narrow, slightly upturned, thickened under umbones. *Left valve* edentate. Cardinal tubercle of *right valve* reduced to absent. Interior of shell pearly white, smooth, with a rounded ridge corresponding to the eternal umbonoventral depression. Length 15.7 mm.

REMARKS. — This species is well characterized by its plump shape and broad posterior rostration. It is somewhat variable in outline and hinge features, with a more or less expanded posterior rostration and a sometimes completely edentate right valve.

Contrary to the opinion of BERNARD *et al.* (1993), which followed that of PRASHAD (1932) and HABE (1952b, 1977, 1981), *P. eximia* cannot belong to *Cetoconcha*, as it has only two pairs of septal openings with crossed filaments and interfilaments. Those features of the septum, investigated by PELSENEER (1911: 78) and KNUDSEN (1967: 305), have been also observed on a dried specimen of the present material (MUSORSTOM 2: stn 25). Considering its ligament and hinge characters, *P. eximia* is best refered to the subgenus *Cetomya*.

Cetoconcha boucheti sp. nov.

Figs 66-69

TYPE MATERIAL. — Holotype db and 1 paratype v, MNHN.

TYPE LOCALITY. — Philippines. MUSORSTOM 2, stn 75, 13°51.9′ N, 120°30.1′ E, 300-330 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* thin, hyaline, inflated, trigonal-ovate, subequivalve, right valve slightly deeper. Strongly inequilateral, rounded anteriorly, produced and rostrate posteriorly. Umbones slightly prosogyrate, about midlength of shell, not very prominent. Anterodorsal margin oblique, regularly rounded; posterodorsal margin sloping, nearly straight, abruptly truncate at posterior end. Ventral margin broadly convex, a little more arcuate near the posterior truncation. Posterior slope of shell laterally compressed, giving a gently concave outline in dorsal view. Sculpture of concentric lines and striae, and of densely set pustules in irregular concentric and radial rows, most abundant near lateral and ventral margins. In addition, there is a fine umbonoventral radial cord, reinforced by periostracal extensions near posteroventral shell margin. Outer surface oily iridescent. Periostracum adherent, light ochre in colour, becoming darker on periphery of valves. Ligament mainly external, long and narrow, supported by a small thickening of hinge margin under the umbones. Hinge feeble. *Left valve* edentate, with slightly protruding anterior and posterior margins. *Right valve* with a small, erect, cardinal denticle. Interior polished, iridescent, with minute radial striae and low concentric growth undulations. Muscle scars obscure.

Measurements: Length 17.7 mm, height 14.5 mm, inflation 11.3 mm.

REMARKS. — In the left valve of the holotype, a small transverse ridge can be seen on inner side of the anterodorsal margin, at about one-third the distance from umbo to the anterior end. This does not appear on the paratype, and must be considered merely as an individual variation.

From the other species of the genus, *C. boucheti* is distinguished by its characteristic outline recalling somewhat that of a *Macoma*, with rounded anterior half and asymmetrically attenuated posterior. It differs from *C. exigua* by its much larger size, a different posterior shape and more crowded rows of pustules.

ETYMOLOGY. — The specific epithet is named for Dr P. BOUCHET.

Source : MNHN, Paris

Cetoconcha exigua sp. nov.

Figs 72-73

TYPE MATERIAL. — Holotype paired valves with traces of dried soft parts, MNHN.

TYPE LOCALITY. — Philippines. MUSORSTOM 2, stn 56, 13°54.1′ N, 119°56.7′ E, 970 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* small, thin, hyaline, ovate, subtruncate posteriorly. Umbones prosogyrate, anterior to midlength of shell, prominent. Anterodorsal margin steeply sloping, evenly curved. Anterior and ventral margins rounded, the latter becoming somewhat flattened posteriorly. Posterodorsal margin oblique, shallowly curved, ending in a deep posterior truncation. Outer surface moderately inflated, with an obscure rounded keel extending from umbo to posteroventral end and delimiting a slightly depressed, triangular posterodorsal slope. Sculpture of radial rows of fine pustules, more prominent posteriorly. Periostracum tenuous but adherent, translucent, shiny pale yellow in colour. Ligament mainly external, long and narrow, supported by a small thickening of hinge margin under and behind the umbones. Hinge feeble, edentate in *left valve*, with a small cardinal tubercle in *right valve*. Interior smooth, faintly irideseent.

Measurements: Length 6.0 mm, height 5.4 mm, inflation 4.1 mm.

REMARKS. — By its relatively high and rostrate outline, *C. exigua* somewhat recalls *Poromya eximia*, but it has a much less inflated shape and sparser pustules on the outer surface. Its cardinal tubercle is also more prominent than that of *P. eximia*. It resembles the Atlantic *C. braziliensis* Allen & Morgan, 1981, which has a similar shape but no umbonoposterior ridge, rays of granules restricted to the posterior region, a less sharply truncate posterior margin, and a completely edentulous hinge in the right valve.

ETYMOLOGY. — The specific name is derived from the Latin *exiguus*, meaning small and scanty.

Cetoconcha gloriosa (Prashad, 1932)

Figs 70-71

Poromya (Cetoconcha) gloriosa Prashad, 1932: 326, pl. 7, figs 29-30.

MATERIAL EXAMINED. — **Indonesia**. CORINDON: stn 208, 0°14.6′ S, 117°52′ E, 150 m, 3 spms.

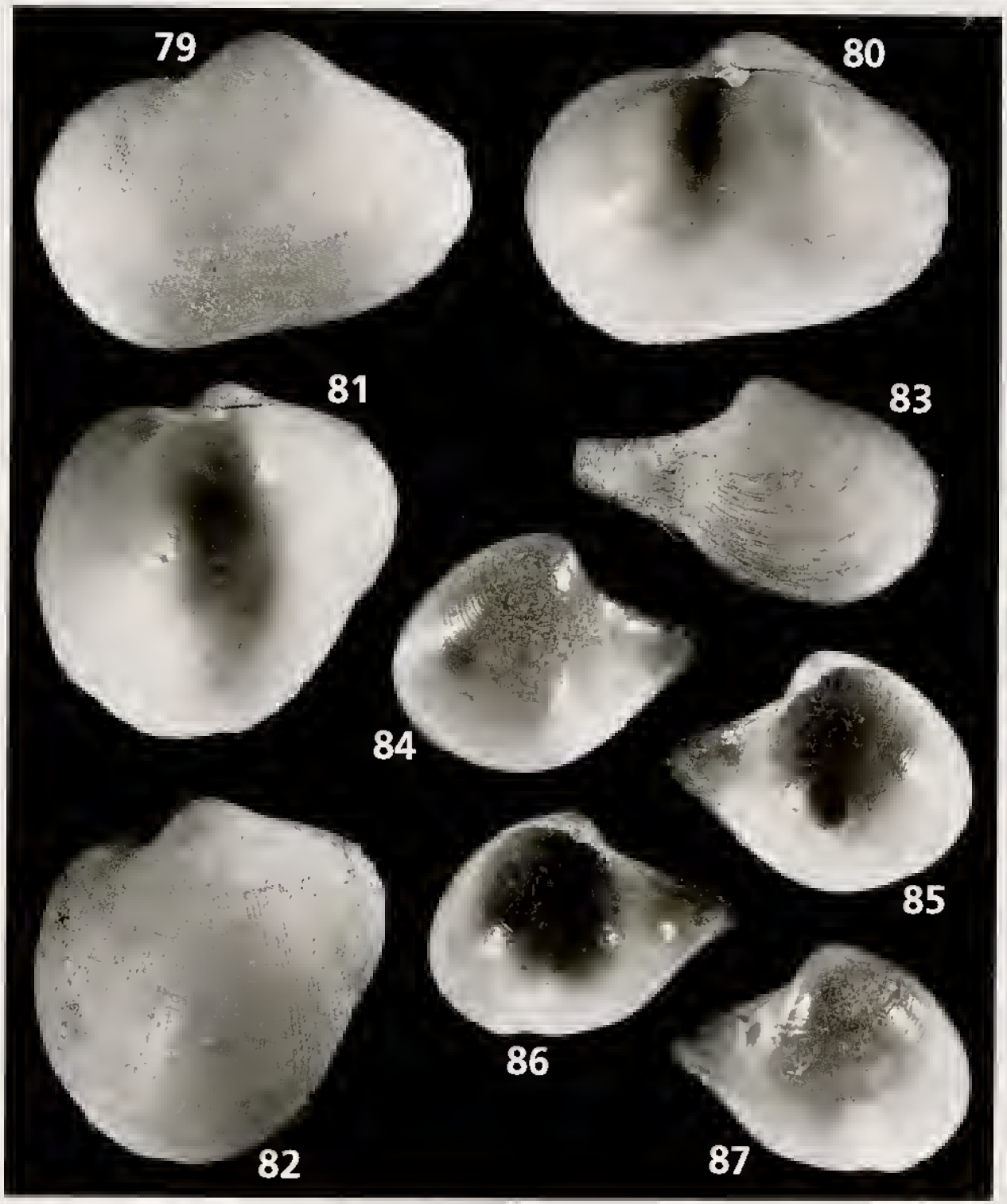
DISTRIBUTION. — Indonesia, East of Flores and Makassar Strait, New Guinea and South China Sea (BERNARD *et al.*, 1993), in 150-400 m.

DESCRIPTION. — *Shell* thin, rather elongate, elliptical-ovate, with a widely rostrate, somewhat compressed posterior end. Subequivalve, right valve slightly larger than left. Umbones subcentral, prosogyrate, inflated, prominent. Sculpture of concentric striae and numerous rows of minute granules, denser on rostrum. Periostracum thin, adherent, light straw in colour. Ligament opisthodetic, mainly external. Hinge feeble, edentate in *left valve*, with a small cardinal dentiele in front of ligament in *right valve*. Interior glossy, somewhat pearly. Length 21.1 mm.

REMARKS. — The present material corresponds rather well with the original diagnosis of *C. gloriosa*, except for the shape of the rostral region, which appears less attenuate than on Prashad's figures. It is thus with some misgiving that these specimens are identified with Prashad's species.

A complete but dead shell of *C. gloriosa* has also been reported by KILBURN (1973: 577) from Natal waters, in 35 m depth. However, description of its hinge leaves doubt about the identity of this form and suggests it belongs to a different species.

Source : MNHN, Paris



FIGS 79-87. — **79-80**, Euciroidae: *Euciroa trapeza*, *"Vauban"* 1978-79: stn 40, paratype, L = 42.0 mm, exterior of left valve (79), interior of right valve (80). — **81-82**, Verticordiidae: *Halicardia philippinensis*, MUSORSTOM 1: stn 44, L = 16.2 mm, interior of right valve (81), exterior of left valve (82). — **83**, Cuspidariidae: *Cuspidaria lubangensis*, MUSORSTOM 1: stn 63, holotype, L = 19.5 mm, exterior of right valve. — **84-87**, Cuspidariidae: *Halonympha leiomyoides*, MUSORSTOM 1: stn 50, holotype, L = 9.0 mm, exterior of left valve (84), interior of left valve (85), interior of right valve (86), exterior of right valve (87).

Source : MNHN, Paris

Cetoconcha japonica Habe, 1952

Fig. 76

Cetoconcha japonica Habe, 1952b: 159, pl. 22, figs 2-4.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 9, 22°20' S, 167°10' E, 175-200 m, 1 v.

DISTRIBUTION. — Japan, Hokkaido to Shikoku, in 200-650 m (HABE, 1977); also in Izu Peninsula, Honshu, in 60-120 m (OKUTANI & MATSUKUMA, 1982). New Caledonia, in 175-200 m (dead).

DESCRIPTION. — *Shell* ovate to elongate. Umbones slightly in front of midlength of valves. Translucent, thin, fragile at juvenile stages; becoming thicker, covered with a velvety, brownish periostracum and attaining a rather large size for the genus (up to 37.5 mm length, *fide* HABE, 1964). Outer surface with numerous minute pustules. A small cardinal tooth present in front of ligament in *right valve*.

REMARKS. — It is with some misgiving that this small damaged right valve (length: 7.9 mm) is identified with *C. japonica*. *Cetoconcha japonica* was first noted as *Cetoconcha* sp. (HABE, 1952a: 274) and described as a new species later in the same year. Anatomy is not known.

CLASSIFICATION

GENERAL REMARKS

The so-called septibranchiate bivalves, currently assigned to the Anomalodesmata (KEEN, 1969; HABE, 1977; VOKES, 1980; BOSS, 1982) or to several orders (NEVESSKAIA *et al.*, 1971; STAROBOGATOV, 1977, 1992; SCARLATO & STAROBOGATOV, 1978, 1979, 1983, 1985; this paper) are, as far as known, exclusively carnivorous with unique features of their alimentary canal and feeding style (YONGE, 1928; PURCHON, 1956, 1987, 1990; MORTON, 1981a, b, 1985c, 1987), and free proteolytic enzymes are present in the stomach (REID, 1977). Although a few benthic Foraminifera, spicules and detrital material may be found in the stomach, the muco-ciliary system necessary for suspension and detrital feeding is absent or vestigial, and septibranchs are not likely to be partially carnivorous as suggested by NAKAZIMA (1967).

The analysis of dietary records (KNUDSEN, 1967, 1970; BERNARD, 1974; KRYLOVA, 1989) and study of functional anatomy strongly suggest that cuspidariids feed mainly on swimming prey, while poromyids and verticordiids catch bottom-dwelling prey (MORTON, 1987). Prey capture has been observed in *Cuspidaria* by REID & REID (1974), and in *Cardiomya* by REID & CROSBY (1980). It is not simply ascomplished by aspiration, but utilizes the protrusion of the inhalant siphon, effected by a complex muscular and haemocoel system. *Poromya* is thought to use a large raptorial hood formed by the eversible, inhalant siphon (MORTON, 1981a). In verticordiids, prey capture has been incorrectly ascribed to "sticky" tentacles (ALLEN & TURNER, 1974), but these have been revealed to be only sensory and not glandular. The mechanism of capture seems rather to depend on the eversion of a short conical siphon or of a raptorial hood (MORTON, 1985a, 1987).

Recent progress, particularly in the functional anatomy, makes necessary a re-evaluation of the systematics of the group. Early workers associated verticordiids, poromyids and cuspidariids in a continuous series of modifications from typically eulamellibranch to entirely gill-less forms, but the new data rather suggest that similarities are the consequence of adaptation to macrophagy

Source : MNHN, Paris

(SALVINI-PLAWEN, 1980; BERNARD, 1983; MORTON, 1985c). However, the origin of the septum is still uncertain — the gill origin school (PELSENEER, 1888a, b, 1891) and the pallial origin school (DALL, 1886a, b, 1888) still have adherents —, and this issue may be finally resolved only by embryological studies (YONGE, 1947). The discovery of cuspidariids with vestigial gills (ALLEN & MORGAN, 1981) does not alter the case. It suggests a progressive reduction of the gills and concurrent formation of the septum. But, while innervation of the septum of *Cardiomya* is distinctly of mantle origin (PLATE, 1897; BERNARD, 1974), it is likely, as suggested by MORTON (1981b), that the development of the septum involved a significant pallial element and may be derived from the taenioid muscles present in *Parilimyia* (MORTON, 1981a, 1982). The family Parilimyidae of the superfamily Pholadomyoidea, while not septibranch, has so many parallel adaptations and so prefigures the superfamilies Verticordioidea and Cuspidarioidea, that it should be included as a potential root lineage.

The following synopsis of classification, based on an original frame elaborated by F.R. BERNARD, considers septibranchs as representative of two orders of the subclass Anomalodesmata.

As proposed by RUNNEGAR (1974), cuspidariids are not thought to be related to the poromyids, and the discovery of *Protocuspidaria* by ALLEN & MORGAN (1981) shows them to be unrelated to the protobranchs (PURCHON 1956, 1960, 1963; BERNARD 1974). The poromyids have a significantly different statocyst structure (MORTON, 1985b) and are placed in the order Poromyoida.

In a short paper overlooked by F. R. BERNARD, SCARLATO & STAROBOGATOV (1983) proposed a new classification of septibranchiate bivalves, mainly based on the structure of septum. A free translation of this paper is given in Appendix 2. Its major difference with other classifications, is a proliferation of family-group or higher-rank taxa, many of which are new. Although the usage of several ordinal taxa can reflect the probable polyphyletic nature of septibranchs, and while some of the divisions may prove to be useful, many of them seem presently unwarranted. This agrees with the conclusions of MAXWELL (1988), who discussed a classification of the Protobranchia established by the same authors. Their system of Septibranchia, which incorporates some of the oldest and most questionable bivalve-like fossils currently known as the Rostroconcha (POJETA & RUNNEGAR, 1976), so greatly differs from the classification expressed in the present paper that it has not been attempted to reconcile the two. Only new genera proposed by SCARLATO & STAROBOGATOV are tentatively included here, because it did not alter the original frame of classification.

SYNOPSIS OF CLASSIFICATION

Subclass ANOMALODESMATA Dall, 1889 [*nom. transl. et correct.* KEEN, 1963]
Order PHOLADOMYOIDA Newell, 1965
Superfamily PHOLADOMYOIDEA Gray, 1847 [*nom. transl.* NEWELL, 1965]

Family PARILIMYIDAE Morton, 1982
- Genus *Parilimya* Melvill & Standen, 1899
- Genus *Panacca* Dall, 1905
  - = *Aporema* Dall, 1903, *non* Scudder, 1890 (Insecta: Capsidae)
- Genus *Nipponopanacca* Habe, 1977

Superfamily VERTICORDIOIDEA Stoliczka, 1871 [*nom. transl.* BERNARD, 1974]
Family VERTICORDIIDAE Stoliczka, 1871
- Genus *Verticordia* J. de C. Sowerby, 1844
  - = *Hippagus* Philippi 1844, *non* Lea, 1833 (Mytilidae); *Hippella* Dall, 1903, *non* Mörch, 1861 (Condylocardiidae); *Iphigenia* Costa, 1850, *non* Schumacher, 1817 (Donacidae)
- Genus *Pecchiolia* Savi & Meneghini, 1851 (fossil: Caenozoic)
- Genus *Vertambitus* Iredale, 1930
- Genus *Simplicicordia* Kuroda & Habe *in* Kuroda, Habe & Oyama, 1971
- Genus *Trigonulina* d'Orbigny, 1846

Source : MNHN, Paris

Genus *Spinosipella* Iredale, 1930
Genus *Haliris* Dall, 1886b
Subgenus *Haliris s. s.*
Subgenus *Setaliris* Iredale, 1930
Subgenus *Vertispliaera* Iredale, 1930
Genus *Halicardia* Dall, 1895b
= *Halicardissa* Dall, 1913; *Haloconcha* Dall, 1900b *nom. null.*
Genus *Kurinuia* Marwick, 1942 (fossil: Paleogene)

Family LYONSIELLIDAE Dall, 1895a
= POLICORDIIDAE Scarlato, 1981
Genus *Policordia* Dall, Bartsch & Rehder, 1938
Subgenus *Policordia s. s.*
= *Latebranchia* Ivanova *in* Scarlato & Starobogatov, 1983
Subgenus *Augustebranchia* Ivanova *in* Scarlato & Starobogatov, 1983
Subgenus *Dallicordia* Scarlato & Starobogatov, 1983
Genus *Laevicordia* Seguenza, 1876a
Genus *Lyousiella* G. O. Sars, 1872
= *Proagorina* Iredale, 1930; *Rectilyonsiella* Scarlato & Starobogatov, 1983; *Allenicordia* Scarlato & Starobogatov, 1983; ?*Spinolyonsiella* Scarlato & Starobogatov, 1983

Family EUCIROIDAE Dall, 1895a
Genus *Euciroa* Dall, 1881
Genus *Acreuciroa* Thiele & Jaeckel, 1931

Superfamily CUSPIDARIOIDEA Dall, 1886b [*nom. transl.* SCARLATO & STAROBOGATOV *in* NEVESSKAIA *et al.*, 1971]
Family CUSPIDARIIDAE Dall, 1886b
Genus *Protocuspidaria* Allen & Morgan, 1981
Subgenus *Protocuspidaria s. s.*
Subgenus *Bidentaria* Allen & Morgan, 1981
Subgenus *Edentaria* Allen & Morgan, 1981
Genus *Pseudoneaera* Sturany, 1901
= *Bendoneaera* Cossmann, 1904, *nom. null.*; *Jeffreysomya* Nordsieck, 1969
Genus *Cuspidaria* Nardo, 1840
= *Neaera* Gray *in* Griffith & Pidgeon, 1834, *non* Robineau-Desvoidy, 1830 (Insecta: Diptera); *Aulacophora* Jeffreys, 1882, *non* Chevrolat *in* Dejean, 1835 (Insecta: Coleoptera); *Alleuineaera* Scarlato & Starobogatov, 1983
Subgenus *Cuspidaria s. s.*
Subgenus *Rhinoclama* Dall & Smith *in* Dall, 1886b
= *Rhinomya* A. Adams, 1864, *non* Robineau-Desvoidy, 1830 (Insecta: Diptera); *Austroneaera* Powell, 1937
Subgenus *Luzonia* Dall & Smith *in* Dall, 1890
Subgenus *Leiomya* A. Adams, 1864
Subgenus *Soyomya* Okutani, 1985
Subgenus *Tergulina* Nosky, 1939 (fossil: Paleogene)
Subgenus *Tropidomya* Dall & Smith *in* Dall, 1886b
= *Tropidophora* Jeffreys, 1882, *non* Troschel, 1847 (Mollusca: Gastropoda); *Gouiophora* Jeffreys, 1883, *non* Phillips, 1848 (Modiomorphidae)
Subgenus *Nordoneaera* Okutani, 1985
Subgenus *Vulcanomya* Dall, 1886b
Genus *Plectodon* Carpenter, 1864
Genus *Halonympha* Dall & Smith *in* Dall, 1886b

Source : MNHN, Paris

Genus *Cardiomya* A. Adams, 1864
= *Spathophora* Jeffreys, 1882, *non* Amyot & Serville, 1843 (Insecta: Hemiptera)
Subgenus *Cardiomya s. s.*
Subgenus *Bowdenia* Dall, 1903 (fossil: Neogene)
Subgenus *Kurodamya* Okutani & Sakurai, 1964
Genus *Bathyneaera* Scarlato & Starobogatov, 1983
= *Semicardiomya* Scarlato & Starobogatov, 1983; *Labromysa* Bernard, 1989
Genus *Boriesia* Doncieux, 1911 (fossil: Paleogene)
Genus *Octoporia* Scarlato & Starobogatov, 1983
Genus *Myonera* Dall, 1886a
Subgenus *Myonera s. s.*
Subgenus *Rengea* Kuroda & Habe *in* Kuroda, Habe & Oyama, 1971
Genus *Fabagella* Cossmann, 1886 (fossil: Paleogene)

Order Poromyoida Pelseneer, 1906 [*nom. correct.* Newell, 1965]
Superfamily Poromyoidea Dall, 1886b [*nom. transl.* Dall, 1895a]
Family Poromyidae Dall, 1886b
Genus *Poromya* Forbes, 1844
= *Embla* Lovén, 1846; *Thetis* H. Adams & A. Adams, 1856, *non* J. de C. Sowerby, 1826 (Mactromyidae); *Ectorisma* Tate, 1892; *Questimya* Iredale, 1930
Subgenus *Poromya s. s.*
Subgenus *Mioporonya* Sacco, 1901 (fossil: Neogene)
Subgenus *Dermatomya* Dall, 1889
Subgenus *Cetomya* Dall, 1889
Genus *Perlaporomya* Scarlato & Starobogatov, 1983
Genus *Neaeroporomya* Cossmann, 1886 (fossil: Paleogene)
Genus *Pseudocuspidaria* Eames, 1951 (fossil: Paleogene)
Genus *Cymella* Meek, 1864 (fossil: Cretaceous)
Genus *Cetoconcha* Dall, 1886b
= *Silenia* E.A. Smith, 1885, *non* Mulsant & Rey, 1874 (Insecta Coleoptera); *Cribrosoconcha* Krylova, 1991
Genus *Liopistha* Meek, 1864 (fossil: Cretaceous)
= *Psilomya* Meek, 1876

DIAGNOSES OF SUPRASPECIFIC TAXA

In this section, diagnoses are only for taxa with Recent representatives. They include also the pholadomyoid family Parilimyidae.

Order Pholadomyoida Newell, 1965

Superfamily Pholadomyoidea Gray, 1847

Family Parilimyidae Morton, 1982

Shell thin, equivalve, gaping at both ends. Sculpture radial, either feeble or strong. Periostracum thin, usually with adherent sand grains. Ligament external, opisthodetic. Hinge plate feeble, edentate or with an anterior tubercle. Pallial line with a moderately deep sinus.

Mantle lobes fused, with an anteroventral pedal gape and a fourth pallial aperture. Mantle margins with arenophilic radial glands. Inhalant siphon very large, eversible; exhalant siphon small. Taenioid muscles present. Foot rounded, elongate. Gills eulamellibranch, with reduced outer

Source : MNHN, Paris

demibranch. Labial palps short, ridged. Stomach features transitional between types II and IV (PURCHON, 1990). Midgut and style-sac conjoined. Intestine passing through the ventricle of heart. Statocyst with a multicellular capsule of ciliated cells and a large free statolith within, either single or associated with a number of small statoconia. Hermaphroditic.

Remarks: This family is included here because it has many of the adaptations shown by the carnivorous groups. It is probably at least partly raptorial, and may be ancestral to the verticordiids (MORTON, 1981a, 1982, 1987).

Superfamily VERTICORDIOIDEA Stoliczka, 1871

Shell inflated, inequilateral, ovate to quadrate or trapezoidal, subequivalve. Outer surface usually with radial sculpture, granulate to spinose, sometimes smooth. Ligament opisthodetic, with resilium supported by a lithodesma. Hinge variable, feeble and edentate to more or less thickened, with cardinal and lateral elements. Interior of valves nacreous. Microstructure of shell with prismatic outer, lenticular nacreous middle, and sheet nacre inner layers.

Mantle lobes fused, with a variable pedal opening and arenophilic radial glands on margins. Inhalant and exhalant apertures usually with short siphonal apparatus, surrounded by large sensory tentacles. Foot digitiform or laterally compressed, often weakly byssate in adult. Septum diaphanous, with reduced eulamellibranch gills. Labial palps mostly small; lips enlarged as an oral funnel. Stomach very muscular, of type II. Two ducts to the digestive diverticula. Midgut and style-sac conjoined. Intestine passing through the ventricle of the heart. Statocyst with a large multicellular capsule of ciliated cells and a single free statolith within. Hermaphroditic.

Family VERTICORDIIDAE Stoliczka, 1871

Shell ovate to trapezoidal, generally with a conspicuous radial sculpture and a well-demarcated lunule. Outer surface frequently granulate or spinose. Hinge with at least a cardinal tubercle in right valve.

Gills reduced. Foot digitiform, often byssate. Labial palps reduced.

Genus *VERTICORDIA* J. de C. Sowerby, 1844

Type species (by monotypy): *Hippagus? cardiiformis* J. de C. Sowerby, 1844. Pliocene, Northern Europe.

Shell inflated, rather solid, usually granulate, pustulate or spinose. Umbones prosogyrate, prominent. Sculpture often with radial riblets or plications. Lunule large, deeply impressed. Hinge plate with a hooked cardinal tubercle in right valve, occasionally with posterior lateral tooth.

Included species: *australiensis* E. A. Smith, *bordaensis*, *expansa*, *granulifera*, *guineensis*, *inornata*, *monosteira*, *perversa*, *quadrata*, *seguenzae*, *tenerrima*, *woodi*.

Genus *VERTAMBITUS* Iredale, 1930

Type species (OD): *Verticordia vadosa* Hedley, 1907a. Recent, Australia.

Shell rather compressed, with prominent umbones. Sculpture of feeble wide radial riblets and rows of pustules on entire surface. Hinge heavy, with at least a strong cardinal tooth in right valve.

Included species: *affinis*, *cuneatus*, *excoriatus*, *torridus*, *triangularis*, *vadosus*.

Source : MNHN, Paris

Genus *Simplicicordia* Kuroda & Habe *in* Kuroda, Habe & Oyama, 1971

Type species (OD): *Thyasira trigonata* Yokoyama, 1922. Pleistocene to Recent, Japan.

Shell small, thin, inflated, subtrigonal. Umbones prosogyrate, not prominent. Anterodorsal margin concave; posterodorsal margin convex. Surface minutely granulated. Sculpture of feeble concentric irregular riblets, corrugating the interior of the shell. No radial sculpture. Hinge plate feeble, with an obscure cardinal denticle in right valve.

Included species: *trigonata*.

Genus *Trigonulina* d'Orbigny, 1846

Type species (by monotypy): *Trigonulina ornata* d'Orbigny, 1846. Recent, Caribbean.

Shell rather compressed, solid. Radial ribs prominent, irregularly spaced, crenulating the ventral shell margin. Lunule deeply impressed. Right valve with a stout, posteriorly recurved cardinal tooth, and a long socket to accomodate the posterior lateral tooth of the opposite valve. Interior brilliantly nacreous.

Included species: *hancocki*, *ornata*.

Genus *Spinosipella* Iredale, 1930

Type species (OD): *Verticordia ericia* Hedley, 1911. Recent, Indo-Pacific.

Shell inflated, solid, with strongly enrolled, prosogyrate umbones overhanging the lunule. Sculpture of prominent, radial ribs crenulating the ventral shell margin. Lunule small, deeply invaginated. Outer surface densely granulate to spinose. Hinge of right valve with a strong cardinal tooth. Left valve usually with a smaller corresponding denticle.

Remarks: Usually treated as a subgenus in *Verticordia*, but the near absence of lunule and hinge features support its separation.

Included species: *acuticostata*, *costeminens*, *deshayesiana*, *ericia*.

Genus *Haliris* Dall, 1886b

Type species (OD): *Verticordia fischeriana* Dall, 1881. Recent, Caribbean.

Shell inflated, finely granulate, with small and regular radial ribs, or with obsolete sculpture. Hinge usually with cardinal tubercles and posterior lateral teeth in both valves, more developed in the right.

Subgenus *Haliris s. s.*

Shell solid, sculpture with wide radial riblets. Lunule shallow. Hinge plate strong; right valve with a stout cardinal tooth and a lateral ridge under posterodorsal margin; left valve with a minute

Source : MNHN, Paris

ephemeral cardinal tubercle and a small posterior lateral tooth. Inner ventral margin of valves crenulated.

Included species: *berenicensis*, *crebrilirata*, *fischeriana*, *granulata*, *jaffaensis*, *lamothei*, *multicostata*, *spinosa*, *teporis*.

Subgenus ***Setaliris*** Iredale, 1930

Type species (OD): *Verticordia setosa* Hedley, 1907a. Recent, New Zealand.

Shell small, solid, quadrate, with numerous radial riblets and intercalated concentric striae. Lunule shallow. Hinge with cardinal and lateral teeth in both valves. Ventral shell margin crenulate, somewhat flexuous.

Included species: *accessa*, *pygmaea*, *setosa*.

Subgenus ***Vertisphaera*** Iredale, 1930

Type species (OD): *Vertisphaera cambrica* Iredale, 1930. Recent, Australia.

Shell thin, sculpture obsolete. Lunule depressed. Hinge plate feeble, right valve with an obscure cardinal tooth. Inner ventral margin of shell smooth.

Remarks: Frequently placed as a subgenus in *Verticordia*, the hinge shows it to be referable to *Haliris*.

Included species: *cambrica*.

Genus *Halicardia* Dall, 1895b

Type species (OD): *Mytilimeria flexuosa* Verrill & Smith *in* Verrill, 1881. Recent, North Atlantic.

Shell large for the group, inflated. Radial sculpture developed either as ribs or strong to feeble plications and furrows, scalloping the ventral shell margin. Outer surface with small granules. Lunule small, deeply impressed. Hinge plate feeble, right valve with a small to obsolete cardinal tooth. Visceral mass with an opisthopodium posterior to the foot.

Remarks: The separation of *Halicardissa* Dall, 1913 (type species: *Verticordia perplicata* Dall, 1890) does not seem to be warranted, neither on conchological nor on anatomical grounds.

Included species: *angulata*, *carinifera*, *ferruginea*, *fischeri*, *flexuosa*, *gouldi*, *houbricki*, *maoria*, *nipponensis*, *perplicata*, *philippinensis*, *saharica*.

Family Lyonsiellidae Dall, 1895a

Shell thin, inequilateral, suborbicular to quadrate, with a reduced sculpture. Lunule obscure. Outer surface with or without granulations. Hinge edentate.

Gills reduced to absent. Foot digitiform, usually with a byssal groove. Labial palps small.

Source : MNHN, Paris

Genus *Policordia* Dall, Bartsch & Rehder, 1938

Type species (OD): *Policordia diomedea* Dall, Bartsch & Rehder, 1938. Recent, Hawaii.

Shell suborbicular to trapezoidal, usually with radiating lirae and concentric marks, often somewhat reinforced by periostracum. Outer surface completely devoid of spines or granulations.

Gills variably reduced to absent.

Remarks: Ivanova (1977) divided *Policordia* into two new subgenera (*Angustebranchia* and *Latebranchia*), thereby extinguishing *Policordia s. s.* However, Ivanova originally failed to designate type species for her two subgenera which are then unavailable, under Article 13b of the Code of Nomenclature, whereas the species described as new in her work are available under Article 11, h, iii, 1.

Subsequently, Ivanova made *Angustebranchia* and *Latebranchia* available (*in* Scarlato & Starobogatov, 1983) as full genera, by the designation of type species and the explicit reference to the diagnoses published in 1977. We agree with Scarlato & Starobogatov to consider that *Latebranchia* is equivalent to *Policordia s. s.*

Subgenus ***Policordia*** *s. s.*

Inhalant aperture with one row of tentacles. Gills wide, fused posterior to the foot. Mouth broad. Bathyal to abyssal.

Included species: *atlantica, cordata, densicostata, diomedea, gemma, grandis, insolita, ivanovae, jeffreysi* (Friele), *lisbethae, murrayi, obliqueovata, olivacea, ovata, papyracea, pilula, radiata, subrotundata.*

Subgenus ***Angustebranchia*** Ivanova *in* Scarlato & Starobogatov, 1983

Type species (OD): *Policordia (Angustebranchia) rectangulata* Ivanova, 1977. Recent, Kurile-Kamchatka Trench.

Inhalant aperture with two rows of tentacles. Gills narrow, free posterior to the foot. Mouth narrow. Hadal.

Included species: *extenta, laevigata, maculata, rectangulata.*

Subgenus ***Dallicordia*** Scarlato & Starobogatov, 1983

Type species (OD): *Lyonsiella alaskana* Dall, 1895b. Recent, East Pacific.

Inhalant aperture with one row of tentacles. Gills absent. Septum thin, with a few pairs of small pores. Mouth large. Bathyal to abyssal.

Included species: *alaskana, ochotica, uschakovi.*

Source : MNHN, Paris

Genus *Laevicordia* Seguenza, 1876a

Type species (subsequent designation by Soot-Ryen, 1966): *Verticordia (Laevicordia) orbiculata* Seguenza, 1876a. Pliocene to Recent, Mediterranean.

Shell suborbicular, with fine granules and obscure radial striae. Hinge margin may be somewhat thickened anteriorly. Gills moderately reduced.

Included species: *abscissa*, *axinoides*, *frieli*, *galatheae*, *horrida*, *insculpta*, *orbiculata*, *pacifica*, *sinuosa*, *smidti*.

Genus *Lyonsiella* G. O. Sars, 1872

Type species (by monotypy): *Pecchiolia abyssicola* G. O. Sars, 1872. Recent, Arctic, North Atlantic.

Shell small, oval to subquadrate, generally with fine pustules or spines and radial striae. Hinge plate feeble, edentate, but anterior of the left valve may be thickened. Inhalant siphon with an eversible raptorial valvule. Taenioid muscles sometimes well developed. Gills moderately reduced.

Included species: *abyssicola*, *agulhasensis*, *compressa*, *curta*, *formosa*, *fragilis*, *magnifica*, *parva*, *perplexa*, *quadrata*, *quaylei*, *subquadrata*.

Family Eucroidae Dall, 1895a

Shell usually thick, solid, with numerous radial riblets or striae. Outer surface finely pustulose or spinose. Lunule weakly demarcated. Hinge plate robust, with variably developed lateral laminae and one or two cardinal teeth. Interior of valves highly nacreous, radially striated.

Mantle margins strongly muscular. Gills with reduced outer demibranch. Foot laterally compressed, without a byssal groove. Labial palps large, striated. Lips produced into lateral bulbs.

Genus *Euciroa* Dall, 1881

Type species (by monotypy; genus name *Euciroa* cited in synonymy): *Verticordia elegantissima* Dall, 1881. Recent, Caribbean.

Shell ovate, inflated. Hinge of right valve with a strong, curved cardinal tooth, and usually a posterior ridge. Left valve with a small cardinal tooth edging the resilifer, and often shallow lateral laminae.

Included species: *aethiopica*, *crassa*, *eburnea*, *elegantissima*, *galatheae*, *granifera*, *mediopacifica*?, *millegemmata*, *pacifica*, *spinosa*, *trapeza*.

Source : MNHN, Paris

Genus *Acreuciroa* Thiele & Jaeckel, 1931

Type species (by monotypy): *Euciroa (Acreuciroa) rostrata* Thiele & Jaeckel, 1931. Recent, Indo-Pacific.

Shell posteriorly produced, somewhat compressed. Right valve with a conical cardinal tooth. Left valve nearly edentate.

Included species: *rostrata*.

Superfamily Cuspidarioidea Dall, 1886b

Shell inflated, strongly inequilateral, rounded to ovate anteriorly, rostrate posteriorly. Most of the time slightly inequivalve, with left valve larger. Sculpture variable, often reduced to absent, sometimes with radial or concentric elements. Outer surface with thin periostracum, generally smooth (rarely granulate). Ligament sunken into a small resilifer, supported by a lithodesma. Hinge feeble, edentate or with small cardinal tubercles and lateral ridges. Interior of valves porcelaneous. Microstructure of shell with homogenous outer and inner layers.

Mantle lobes fused, with a small pedal opening. Inhalant and exhalant apertures with well developed siphons united at their base and with seven prominent sensory tentacles. Exhalant siphon short and eversible; inhalant siphon relatively large and forcefully extensible to capture swimming prey. Foot digitiform, with a byssal groove. Adult not byssate. Gills generally absent. Septum usually muscular, with a number of paired pores (usually four or five pairs of pores). Labial palps small, flap-shaped (posterior palps cup-shaped, when developed). Stomach very muscular, of type II. Two ducts to the digestive diverticula. Midgut and style-sac separated. Intestine passing through the ventricle of the heart. Statocyst with a small capsule comprising a few swollen and microvillose cells, and a large, ovate, not freely mobile statolith within. Dioecious.

Family Cuspidariidae Dall, 1886b

Characters same as for the superfamily.

Genus *Protocuspidaria* Allen & Morgan, 1981

Type species (OD): *Protocuspidaria verityi* Allen & Morgan, 1981. Recent, Atlantic.

Shell equivalve, rounded, laterally compressed; rostrum short, truncate. Hinge edentate, or with anterior lateral tooth in one or both valves. Septum thin, membranous, with two longitudinal rows of gill filaments but no muscle attachments to the shell. Posterior labial palps large, cup-shaped.

Remarks: This very interesting genus may represent a transitional stage in the development of the gill-less cuspidariids (Allen & Morgan 1981). The division of the representatives into three subgenera may be premature as the hinge dentition may be mutable.

Subgenus *Protocuspidaria s. s.*

Hinge of right valve with an anterior lateral tooth. Left valve edentate.

Included species: *verityi*.

Source : MNHN, Paris

Subgenus ***Bidentaria*** Allen & Morgan, 1981

Type species (OD): *Protocuspidaria (Bidentaria) atlantica* Allen & Morgan, 1981. Recent, North Atlantic.

Hinge of both valves with an anterior lateral tooth.

Included species: *aequatorialis*?, *atlantica*, *colpodes*?

Subgenus ***Edentaria*** Allen & Morgan, 1981

Type species (OD): *Protocuspidaria (Edentaria) simplis* Allen & Morgan, 1981. Recent, North Atlantic.

Hinge of both valves edentate.

Included species: *ruginosa*?, *simplis*, *thomassini*.

Genus *Pseudoneaera* Sturany, 1901

Type species (by monotypy): *Pseudoneaera thaumasia* Sturany, 1901. Recent, Red Sea.

Rostrum short, trigonal. Hinge of right valve with anterior and posterior cardinal teeth. Left valve with an anterior cardinal tooth.

Included species: *minor*, *periplomoides*?, *semipellucida*, *tasmanica*?, *thaumasia*, *trigonalis*?, *truncata*, *wellmani*.

Genus *Cuspidaria* Nardo, 1840

Type species (by monotypy): *Cuspidaria typus* Nardo, 1840 = *Tellina cuspidata* Olivi, 1792. Recent, Northeast Atlantic, Mediterranean.

Outline globular to ovate; rostrum variably developed, often prominent. Left valve slightly more convex. Hinge teeth present, at least in the right valve. Septum muscular, usually with four or five pairs of pores, with both anterior and posterior muscle attachments to the shell. Labial palps small.

Remarks: The general arrangement of the genus depends on the type and presence of hinge teeth, which seem rather mutable.

Subgenus ***Cuspidaria*** *s. s.*

Outer surface smooth or with concentric lirae. Rostrum often well developed. Hinge of right valve with a posterior lateral tooth. Left valve edentate.

Included species: *abyssopacifica*, *angasi*, *annandalei*?, *apodema*, *approximata*, *arctica*, *arcuata*, *ascoldica*, *atlantica*, *azorica*?, *barnardi*, *bicarinata*, *brachyrhynchus*, *braziliensis*?, *buccina*, *capensis*,

Source : MNHN, Paris

chinensis, *circinata*, *cochiuensis*?, *concentrica*, *consociata*, *contracta*, *convexa* Pelseneer, *corrugata*, *cowani*, *cuspidata*, *delli*, *dissociata*, *elegans*, *elliptica*?, *erma*, *exarata*, *exigua*, *fairchildi*, *formosa*, *fraterna*, *gigantea* Prashad, *glacialis*, *gracilis*, *guineensis*?, *haasi*, *halei*, *hawaiensis*, *hindsiana*, *hyalina*?, *imbricata*, *infelix*, *japonica*, *jeffreysi*, *jugosa* Wood?, *kergueleusis*, *kurodai*, *kyushuensis*, *lamellosa* G. O. Sars, *latesulcata*, *lubangensis*, *macrorhyncluis*, *maxima*, *media*, *meridionalis*, *microrhina*, *initis*, *morelandi*, *morioria*?, *morrisae*, *nasuta* A. Adams, *natalensis*, *nobilis*, *obesa*, *obtusirostris*, *occidna*, *okezoko*, *optima*, *panamensis*, *papyria*?, *parapodema*, *parkeri*, *parva*, *patagonica*, *pellucida*, *platensis*, *prolatissima*, *rosea*, *rostrata*, *sadoensis*, *semirostrata*, *solidula*, *steindachneri*, *subglacialis*, *subtorta*, *suganumai*. *sulcifera*, *tenella*, *teramachii*, *tomlini*, *trailli*, *trigona*?, *truncata*?, *tuhua*, *turgida*, *undata*, *variola*, *ventricosa*. *willetti*, *wollastonii*.

Subgenus ***Rhinoclama*** Dall & Smith *in* Dall, 1886b

Type species (ICZN Opinion 1376): *Cuspidaria (Rhinoclama) adamsi* Morgan & Heppell *in* Allen & Morgan, 1981. Recent, Philippines.

Rostrum moderately extended, with two radial ridges. Outer surface with fine concentric striations. Hinge of right valve with triangular anterior and posterior lateral teeth. Left valve edentate.

Remarks: The group was established as *Rhinonya* A. Adams, 1864, as a subgenus of *Neaera*, but was preoccupied. *Rhinoclama* Dall & Smith (*in* Dall, 1886b) was proposed as a replacement name, but a nomenclatural problem existed for a number of years, because the type species was a *nomen nudum*. The result of an inadequate nomenclatural action by STOLICZKA (1871) merged *Luzonia* Dall & Smith (*in* Dall, 1890) as a synonym, although the differences between the two had already been quoted by E. A. SMITH (1885). The situation was finally regularized by HEPPELL & MORGAN (1983) and Opinion 1376 of the ICZN (1986).

Included species: *abrupta*, *adamsi* Heppell & Morgan, *alta*, *aupouria*, *benthedii*, *brevirostris* Powell, *dorsirecta*, *dubia* Pelseneer, *filatovae*, *finlayi*, *halimera*, *nitens*, *notabilis*, *raoulensis*, *rugata* A. Adams, *similis*, *semistrigosa*, *simulans*, *teres*, *testai*, *valdiviae*.

Subgenus ***Luzonia*** Dall & Smith *in* Dall, 1890

Type species (ICZN Opinion 1376): *Neaera philippinensis* Hinds, 1843. Recent, Philippines.

Rostrum short, tapered, largely confluent with the disc. Hinge of right valve with an anterior cardinal tooth, frequently twisted. Left valve edentate.

Remarks: STOLICZKA (1871) designated *Neaera phillipinensis* (a lapsus for *philippinensis*) Hinds as the type of *Rhinonya*, thereby merging *Luzonia* as an objective synonym. THIELE (1934), following the brief diagnosis of E. A. SMITH (1885), proposed *Cuspidaria adamsi* as a substitute name for *Neaera philippinensis* "A. Adams" *non* Hinds, 1843. As this was a *nomen nudum*, its substitute has no nomenclatural status. HEPPELL & MORGAN (1983) reviewed the situation and showed that *N. philippinensis* Hinds, 1843, is the type of *Luzonia*. This genus name has been validated by Opinion 1376 of the ICZN (1986).

Included species: *chilensis*, *philippinensis* Hinds, *simplex*, *walleri*.

Source : MNHN, Paris

Subgenus ***Leiomya*** A. Adams, 1864

Type species (by monotypy): *Neaera adunca* Gould, 1861. Recent, Japan.

Outer surface smooth. Rostrum short, trigonal. Hinge of both valves with an anterior cardinal tooth, that of the right valve usually strongly bifid. Right valve also with an anterior and a posterior lateral tooth.

Included species: *adunca* Gould, *inflata*.

Subgenus ***Soyomya*** Okutani, 1985

Type species (by monotypy): *Cuspidaria kurohijii* Okutani, 1972. Recent, Japan.

Rostrum short, wide. Outer surface with a complex oblique sculpture. Right valve with a posterior lateral tooth. Left valve edentate.

Included species: *clathrata*, *kurohijii*.

Subgenus ***Tropidomya*** Dall & Smith *in* Dall, 1886b

Type species (by monotypy): *Neaera abbreviata* Forbes, 1843. Recent, Northeast Atlantic, Mediterranean.

Rostrum short, trigonal. A small anterior cardinal tooth in both valves.

Included species: *abbreviata*, *diagonalis*.

Subgenus ***Nordoneaera*** Okutani, 1985

Type species (by monotypy): *Cuspidaria trosaetes* Dall, 1925. Recent, Japan.

Shell stout, rostrum very short, with obscure boundary. Hinge of right valve with a posterior lateral tooth. Left valve edentate.

Included species: *trosaetes*.

Subgenus ***Vulcanomya*** Dall, 1886b

Type species (by monotypy): *Vulcanomya smithii* Dall, 1886b = *Neaera aduuca* "Gould" E. A. Smith, 1885 (*non* Gould, 1861).

Rostrum short, trigonal. Hinge of right valve with a short trigonal lateral tooth on either side of the resilifer. Left valve with a tiny double notch in the anterior dorsal margin.

Included species: *smithii*.

Source : MNHN, Paris

Genus *Plectodon* Carpenter, 1864

Type species (OD): *Plectodon scaber* Carpenter, 1864. Recent, East Pacific.

Outer surface dull, usually granulate. Anterodorsal margin of valves spirally incurved. Hinge of right valve with elongate, reflected anterior and posterior lateral teeth. Left valve edentate. Septum relatively thin, with generally five pairs of pores, and both anterior and posterior muscle shell attachments. Labial palps small.

Remarks: This genus has been frequently but erroneously listed as a subgenus of *Leiomya*. It is treated as a subgenus of *Cuspidaria* by Allen & Morgan (1981).

Included species: *brazieri, granulatus, ligula, scaber.*

Genus *Halonympha* Dall & Smith *in* Dall, 1886b

Type species (OD): *Neaera claviculata* Dall, 1881. Recent, West Central Atlantic.

Shell ovate; rostrum merged with disc. Hinge of right valve with a small knob-like cardinal tooth. A raised oblique buttress or ridge along the posterodorsal margin of either valve. Septum with more than five pairs of pores, without posterior dorsal attachments to the shell. Posterior labial palps large, cup-shaped.

Remarks: Allen & Morgan (1981) separated the group at the genus level on the basis of significant anatomical differences.

Included species: *aethiopica, asiatica, atlanta, claviculata, congenita, depressa, ledaeformis?, leiomyoides, ros, salamensis, striatella.*

Genus *Cardiomya* A. Adams, 1864

Type species (by monotypy): *Neaera gouldiana* Hinds, 1843. Recent, Western Pacific.

Radial sculpture developed, at least on posterior half of disc. Rostrum frequently elongate. Right valve with a posterior lateral tooth. Septum muscular, with four pairs of pores; a small lateral septal muscle generally present, besides the anterior and posterior muscle shell attachments.

Remarks: Anatomically, the genus does not differ much from *Cuspidaria*, and Allen & Morgan (1981) merged them. The consistent differences in sculpture and general more shallow distribution of *Cardiomya* suggests its separation.

Subgenus *Cardiomya s .s.*

Radial sculpture developed over entire disc. Right valve with a posterior lateral tooth. Left valve edentate.

Included species: *abyssicola, alcocki, alternata, alveata, andamanica, angusticauda, balboae, behringensis, bruuni, californica, casta, chuni, cleryana, concinna, costata, costellata, curta* Jeffreys, *didyma, ecuadoriana, filatovae, forticostata, fragilissima, fujitai, gilchristi, gouldiana, greenii, iturupica, kashimana, knudseni, lanieri, nipponica, obliqua, ochotensis, orientalis, ornatissima, pectinata, perrostrata, pinna, planetica, rectimarginata, reticulata, saba, sibogai, singaporensis, sinica, striata, striolata, surinamensis, tosaensis.*

Source : MNHN, Paris

Subgenus *Kurodamya* Okutani & Sakurai, 1964

Type species (by monotypy): *Cuspidaria (Cardiomya) fortisculpta* Kuroda, 1948. Recent, Japan.

Radial sculpture absent from the anterior slope of the disc. Right valve with a prominent, often hook-shaped, posterior lateral tooth. Left valve edentate.

Remarks: A useful division, merged by ALLEN & MORGAN (1981) into *Cardiomya*.

Included species: *fallax*?, *fortisculpta*, *levifrons*, *semicostata*.

Genus *BATHYNEAERA* Scarlato & Starobogatov, 1983

Type species (by monotypy): *Cuspidaria hadalis* Knudsen, 1970. Recent, Banda Trench.

Sculpture a complex of radial riblets and concentric lirae, more developed on posterior slope. Rostrum compressed, truncate, merged with disc. Hinge of both valves edentate. Septum muscular, with four pairs of pores; an extra lateral septal muscle attached on posterior part of shell, besides the other posterior muscles.

Remarks: BERNARD (1989) created *Labromysa* (type species: *Cardiomya (Labromysa) disa* Bernard, 1989) as a subgenus of *Cardiomya*, to accomodate species with external shell features similar to *Myonera* Dall, 1886a, but anatomically assignable to *Cardiomya*, and with a feeble edentate hinge plate. He tentatively included in it *Myonera laticella* Dall, 1888b and *Cuspidaria hadalis* (the type species of *Bathyneaera*). Consequently, *Labromysa* is considered here to be a synonym of *Bathyneaera*. KRYLOVA (1993) revised the genus, merging in it *Semicardiomya* Scarlato & Starobogatov, 1983.

Included species: *bernardi*, *disa*, *globulosa*, *hadalis*, *laticella*, *paleifera*, *quadrostrata*, *tillamookensis*.

Genus *OCTOPORIA* Scarlato & Starobogatov, 1983

Type species (OD): *Cuspidaria (Myonera) octaporosa* Allen & Morgan, 1981. Recent, North Atlantic.

Shell ovate, with a well developed, broad rostrum. Sculpture of low concentric ribs. Hinge of both valves edentate. Septum with eight to twenty pairs of pores, with feeble posterodorsal attachments to the shell. Posterior labial palps large, cup-shaped.

Remarks: KRYLOVA (1994b) revised *Octoporia* and assigned to it a number of new species in addition to the type and only known species, showing then it is worth of generic recognition. The genus accomodates species with shell features recalling *Myonera* Dall, 1886a, but anatomically similar to *Halonympha* Dall & Smith *in* DALL, 1886b.

Included species: *octaporosa*, *podobeda*, *rugosa*, *sinuosa*.

Genus *MYONERA* Dall, 1886a

Type species (subsequent designation by DALL & SMITH *in* DALL, 1886b): *Myonera paucistriata* Dall, 1886b. Recent, North Atlantic.

Source : MNHN, Paris

Sculpture with concentric, and sometimes radial elements. Hinge plate feeble, edentate in both valves. Septum muscular, with four pairs of pores. Labial palps small.

Remarks: In a short note to *Nature* published 10 June 1886, DALL introduced *Myonera*, as a subgenus of *Neaera* (an older but invalid name for *Cuspidaria*). The anatomical description he gave, based on a new (but unnamed) species of *Myonera* from the Gulf of Mexico, made it available as a genus-group name without named species. Later (September 1886), DALL & SMITH (*in* DALL 1886b: 302) defined *Myonera* as a full genus, providing a list of species to be included in it, and designating *Myonera paucistriata* Dall as the type species.

Subgenus ***Myonera*** *s. s.*

Sculpture complex of radial and concentric elements. Resilifer posteriorly directed, or nearly vertical.

Included species: *acutecarinata, alleni, angularis, bicarinata, canariensis, centobi, dautzenbergi, dispar, garretti, gigantea, lamellifera, limatula, lischkei, mexicana, pailoloana, paucistriata, pretiosa*?, *rostra, tasmanica.*

Subgenus ***Rengea*** Kuroda & Habe *in* Kuroda, Habe & Oyama, 1971

Type species (OD): *Myouera fluctuosa* Kuroda, 1948 = *Cuspidaria (Myonera) caduca* E. A. Smith, 1894. Recent, Indo-Pacific.

Sculpture of the disc with strong concentric plications. Umbones depressed, opisthogyrate. Resilifer projecting, subvertical.

Included species: *caduca, murrayi.*

Order POROMYOIDA Pelseneer, 1906

Superfamily POROMYOIDEA Dall, 1886b

Shell inflated, ovate to rhomboidal or trigonal, subequivalve. Posterior rostrum absent. Outer surface with adherent periostracum, smooth or granulate to spiculate. Ligament external, opisthodetic, without a lithodesma. Dorsal margins of valves united by fused periostracum. Hinge edentate, or with a variable cardinal tooth in right valve. Interior of valves nacreous. Microstructure of shell with prismatic outer and nacreous middle and inner layers, or with a two-layered homogenous structure.

Mantle lobes fused, with a large pedal opening. Inhalant and exhalant apertures with siphons, surrounded with up to 15 stout sensory tentacles. Exhalant siphon short; inhalant siphon eversible in a large raptorial hood. Foot digitiform, with a byssal groove. Adult usually not byssate. Gills absent. Septum muscular, with two or three (rarely one) pairs of ostial openings. Labial palps cup-shaped, the anterior ones large. Stomach very muscular, of type II. Two ducts to the digestive diverticula. Midgut and style-sac conjoined. Intestine passing through the ventricle of the heart. Statocyst with a large multicellular capsule of ciliated cells and a single free statolith within. Hermaphroditic.

Source : MNHN, Paris

Family POROMYIDAE Dall, 1886b

Characters same as for the superfamily.

Genus *POROMYA* Forbes, 1844

Type species (by monotypy): *Poromya anatinoides* Forbes, 1844 = *Corbula granulata* Nyst & Westendorp, 1839. Pliocene to Recent, Arctic, North Atlantic and Mediterranean.

Shell surface smooth or granulate. Hinge with or without a cardinal tooth in right valve. Septum with two pairs of ostial openings.

Subgenus ***Poromya*** *s. s.*

Shell surface with small granules, frequently set in rows. Ligament external, but deeply sunken. Right valve with an anterior cardinal tooth.

Included species: *adelaidis*, *australis*, *curta*, *cymata*, *flexuosa*, *gilchristi*, *granosissima*, *granulata* Nyst & Westendorp, *granuloderma*, *hayashii*, *houbricki*, *laevis*, *neaeroides*, *neozelanica*, *rostrata*, *sansibarica*, *spinulosa*, *striata*, *sumatrana*, *tornata*, *transversa*, *umbonata*, *undosa*.

Subgenus ***Dermatomya*** Dall, 1889

Type species (by monotypy): *Poromya (Dermatomya) mactroides* Dall, 1889. Recent, Eastern Pacific.

Shell surface smooth, without granulation. Ligament external, but deeply sunken. Hinge rather strong, cardinal tooth of right valve large, frequently knob-like.

Included species: *buttoni*, *castanea*, *chilensis*, *hyalina*, *mactroides*, *tenuiconcha*, *trosti*.

Subgenus ***Cetomya*** Dall, 1889

Type species (subsequent designation by GLIBERT, 1936): *Poromya elongata* Dall, 1886b. Recent, West Central Atlantic.

Shell surface granulate. Ligament external, not deeply sunken. Hinge plate feeble, cardinal tooth of right valve vestigial or absent.

Included species: *albida*, *butoni*, *elongata*, *eximia* Pelseneer, *malespinae* Ridewood, *niasensis*?, *orientalis*, *scapha*.

Genus *PERLAPOROMYA* Scarlato & Starobogatov, 1983

Type species (OD): *Poromya perla* Dall, 1908. Recent, East Pacific.

Shell surface granulate, with very high, bulbous umbones. Ligament external, but deeply

Source : MNHN, Paris

sunken. Hinge with a strong cardinal tooth in right valve, and a corresponding socket in left valve. Septum with only one pair of ostial openings.

Included species: *perla*.

Genus *Cetoconcha* Dall, 1886b

Type species (OD): *Lyonsia bulla* Dall, 1881. Recent, tropical West Atlantic.

Shell surface granulate or spiculated. Ligament external, slightly sunken. Hinge feeble; anterior cardinal tooth of right valve reduced or absent. Septum with three pairs of ostial openings.

Included species: *alephtinae, angolensis, atypha, boucheti, braziliensis, bulla, ceylonensis, elegans, exigua, galatheae, gloriosa, indica, japonica, margarita, pelseneeri, sarsii, smithii, tenuissima, transversa*.

CATALOGUE OF RECENT SPECIES

In the following alphabetical list, the generic attributions and synonymies are only tentative because, for many species, information is scarce, too scattered or obsolete. Some genera are mainly distinguishable on anatomical grounds, but these data are not available for many species, hence many confusions in generic or even familial allocations (see, for example, Poutiers, 1984: 285; Dell, 1990: 61).

In two publications dealing with the anatomy of bivalves, Ridewood (1903) and Pelseneer (1911) described the soft parts of some new septibranch species. The shells of these species were later named and described as new, respectively by Dall (1916a, b) and Prashad (1932). Although a few authors, among which F. R. Bernard, rejected the names introduced by Ridewood and Pelseneer, these are tentatively included herein. However their somewhat uncertain nomenclatural status has to be reconsidered on an individual basis in a thorough revision of the group.

Names of valid species are in bold. Current generic allocation is in square brackets.

abbreviata, *Neaera* Forbes, 1843: 75. Northeast Atlantic, Mediterranean. 55-1350 m. **[*Cuspidaria (Tropidomya)*]**

abrupta, *Cuspidaria* (*Rhinoclama*) Allen & Morgan, 1981: 479. Southeast Atlantic. 619-1014 m. **[*Cuspidaria (Rhinoclama)*]**

abscissa, *Lyonsiella* Pelseneer, 1911: 76. Indo-Pacific. 700-850 m. **[*Laevicordia*]**

abyssicola, *Cardiomya* Verrill & Bush, 1898: 806. Northwest & West Central Atlantic. 2840-3316 m. **[*Cardiomya*]**

abyssicola, *Lyonsiella* M. Sars, 1869: 257, *nom. nud.* = *Lyonsiella abyssicola* (G.O. Sars, 1872)

abyssicola, *Pecchiolia* G. O. Sars, (*ex* M. Sars MS) 1872: 25. Arctic, North Atlantic. 38-3909 m. **[*Lyonsiella*]**

abyssopacifica, *Cuspidaria* Okutani, 1975b: 74. Northwest Pacific. 3420-5620 m. **[*Cuspidaria*]**

accessa, *Setaliris* Iredale, 1930: 388. Southwest Pacific. 457-550 m. **[*Haliris (Setaliris)*]**

actoni, *Neaera* Tiberi, 1855: pl. 1. = *Cardiomya costellata* (Deshayes, 1833)

acutecarinata, *Cuspidaria* Dautzenberg & Fischer, 1906: 95. East Central Atlantic. 628 m. **[*Myonera*]**

acuticostatus, *Hippagus* Philippi, 1844: 42. Central Atlantic, Mediterranean. 99-4255 m. **[*Spinosipella*]**

adamsi, *Cuspidaria* Thiele, 1934 (*nom. nov. pro Cuspidaria philippinensis* "Hinds", A. Adams, 1864): 948, *nom. nud.* = *Cuspidaria* (*Rhinoclama*) *adamsi* Heppell & Morgan, 1981

Source : MNHN, Paris

adamsi, *Cuspidaria* (*Rhinoclama*) Heppell & Morgan, 1981: 546. West Pacific. 38-46 m. **[*Cuspidaria (Rhinoclama)*]**
adelaidis, *Pholadomya* Hedley, 1916: 29. Antarctic. 110-2154 m. **[*Poromya*]**
adunca, *Neaera* Gould, 1861: 24. Northwest Pacific. 10-600 m. **[*Cuspidaria (Leiomya)*]**
adunca, *Neaera* "Gould" E.A. Smith 1885: 37, *non* Gould 1861. = *Cuspidaria (Vulcanomya) smithii* Dall, 1886b
aequacostata, *Verticordia* Howard, 1950: 109. = *Haliris fischeriana* (Dall, 1881)
aequatorialis, *Cuspidaria* Thiele & Jaeckel, 1931: 253. Indian Ocean. 693-750 m. **[*?Protocuspidaria (Bidentaria)*]**
aethiopica, *Cuspidaria* Thiele & Jaeckel, 1931: 254. West Indian Ocean. 693 m. **[*Halomympha*]**
aethiopica, *Euciroa* Thiele & Jaeckel, 1931: 248. West Indian Ocean. 818-977 m. **[*Euciroa*]**
affinis, *Verticordia* Thiele & Jaeckel, 1931: 247. West Indian Ocean. 693-1134 m. **[*Vertambitus*]**
agulhasensis, *Cuspidaria* Thiele & Jaeckel, 1931: 253. = *Cuspidaria optima* Sowerby, 1904
agulhasensis, *Lyonsiella* Thiele & Jaeckel, 1931: 250. South Africa. 50-250 m. **[*?Lyonsiella*]**
alaskana, *Lyonsiella* Dall, 1895b: 703. East Pacific. 800-3570 m. **[*Policordia (Dallicordia)*]**
albida, *Poromya* (*Cetoconcha*) Dall. 1886b: 282. Northwest & West Central Atlantic. 175-1337 m. **[*Poromya (Cetomya)*]**
alcocki, *Cuspidaria* E. A. Smith, 1894: 170. Indo-Pacific. 60-1150 m. **[*Cardiomya*]**
alephtinae, *Cribrosocoucha* Krylova, 1991: 133. Southeast Pacific, 1014-1058 m. **[*Cetoconcha*]**
alleni, *Myonera* Poutiers, *nom. nov. pro Cuspidaria* (*Myonera*) *atlantica* Allen & Morgan, 1981: 470. North Atlantic. 1427-4680 m. **[*Myonera*]** (see note 1 below).
alta, *Cuspidaria* Verco, 1908: 198. Southern Australia. 165-275 m. **[*Cuspidaria (Rhinoclama)*]**
alternata, *Sphena* d'Orbigny *in* de la Sagra, 1846: 286. West Central Atlantic. 24-340 m. **[*Cardiomya*]**
alveata, *Cuspidaria* Hedley, 1907b: 362. Southwest Pacific. 1500 m. **[*Cardiomya*]**
anatinoides, *Poromya* Forbes, 1844: 191. = *Poromya granulata* (Nyst & Westendorp, 1839)
andumanica, *Cardiomya* Preston, 1916b: 99. Indian Ocean. 3-10 m. **[*Cardiomya*]**
angasi, *Neaera* E. A. Smith, 1885: 47. Southern Australia. 238-750 m. **[*Cuspidaria*]**
angolensis, *Cetoconcha* Allen & Morgan, 1981: 528. Southeast Atlantic. 5124 m. **[*Cetoconcha*]**
angularis, *Neaera* Jeffreys, 1876: 498. North Atlantic. 530-3265 m. **[*Myonera*]**
angulata, *Pecchiolia* Jeffreys, 1882: 933. Northeast Atlantic, Azores. 454-1429m. **[*Halicardia*]**
angusticauda, *Cardiomya* Scarlato, 1972: 124. Northwest Pacific. 135-664m. **[*Cardiomya*]**
annandalei, *Cuspidaria* Preston, 1915: 308. Indian Ocean. Shallow water. [Taxonomic status uncertain]
antarctica, *Pholadomya* Hedley, 1916: 28. =? *Poromya adelaidis* (Hedley, 1916), *fide* DELL, 1990.
apodema, *Cuspidaria* Dall, 1916a: 23, *nom. nud.*; 1916b: 407. Northeast Pacific. 1098-2900 m. **[*Cuspidaria*]**
approximata, *Cuspidaria* E. A. Smith, 1896: 373. Indian Ocean. (46?), 400-786 m. **[*Cuspidaria*]**
arctica, *Neaera* M. Sars, 1859: 62. Arctic, North Atlantic. 35-1190 m. **[*Cuspidaria*]**
arcuata, *Neaera* Dall, 1881: 113. West Central Atlantic. 1170 m. **[*Cuspidaria*]**
ascoldica, *Cuspidaria* Scarlato, 1972: 121. Northwest Pacific. 100-800 m. **[*Cuspidaria*]**
asiatica, *Halonympha* Hayami & Kase, 1993: 103. Northwest Pacific. 7-20 m. **[*Halonympha*]**
atlanta, *Halonympha* Allen & Morgan, 1981: 494. Northwest & East Central Atlantic. 2644-3128 m. **[*Halonympha*]**
atlantica, *Cuspidaria* Allen & Morgan, 1981: 455. Atlantic. 530-2154 m. **[*Cuspidaria*]**
atlantica, *Cuspidaria* (*Myonera*) Allen & Morgan, 1981: 470, *non Cuspidaria atlantica* Allen & Morgan, 1981. = *Myonera alleni* Poutiers, *nom. nov.* (see note 1 below).
atlantica, *Policordia* Allen & Turner, 1974: 484. North Atlantic. 458-2186 m. **[*Policordia*]**
atlantica, *Protocuspidaria* (*Bidentaria*) Allen & Morgan, 1981: 499. North Atlantic, Canaries. 1150-4706 m. **[*Protocuspidaria (Bidentaria)*]**
attenuata, *Neaera* Forbes, 1843: 75. = *Cuspidaria rostrata* (Spengler, 1793)
atypha, *Cetoconcha* Verrill & Bush, 1898: 814. Northwest Atlantic. 2602 m. **[*Cetoconcha*]**
aupouriu, *Cuspidaria* Dell, 1950: 21. Southwest Pacific. 137-805 m. **[*Cuspidaria (Rhinoclama)*]**

Source : MNHN, Paris

australiensis, *Verticordia* Hedley, 1907a: 303, *non* E. A. Smith, 1885. = *Verticordia bordaensis* Cotton & Godfrey, 1938.
australiensis, *Verticordia* E. A. Smith, 1885: 167. Southwest Pacific. 285 m. **[*Verticordia*]**
australis, *Poromya* E. A. Smith, 1885: 54. West Pacific. 83-283 m. **[*Poromya*]**
axinoides, *Verticordia* (*Laevicordia*) Seguenza, 1876a: 111. Mediterranean. 250-400 m. **[*Laevicordia*]**
azorica, *Neaera* E.A. Smith, 1885: 41. Mid Atlantic. 1829 m. **[*?Cuspidaria*]**
balboae, *Cardiomya* Dall, 1916b: 407. East Central Pacific. 45-170 m. **[*Cardiomya*]**
barnardi, *Cuspidaria* Knudsen, 1970: 139. Atlantic, Indian Ocean. 2178-3828 m. **[*Cuspidaria*]**
batialis, *Cardiomya lindbergi* Scarlato, 1972: 124. = *Cardiomya gouldiana* (Hinds, 1843)
behringensis, *Neaera* Leche, 1883: 438. North Pacific. 18-2900 m. **[*Cardiomya*]**
benthedii, *Cuspidaria* Poutiers, 1984: 289. Indian Ocean. 3700-3716 m. **[*Cuspidaria (Rhinoclama)*]**
bereuicensis, *Pecchiolia* Sturany, 1896: 15. Mediterranean. 700 m. **[*Haliris*]**
beringiana, *Dermatomya* Dall, 1916a: 22, *nom. nud.*; 1916b: 406. = *Poromya* (*Dermatomya*) *tenuicoucha* Dall, 1913
bernardi, *Bathyneaera* Krylova, 1993: 58. Tropical West Pacific. 7800-7870 m. **[*Bathyneaera*]**
bicarinata, *Myonera* E. A. Smith, 1896: 374. Indian Ocean. 660-1163 m. **[*Myonera*]**
bicurinata, *Neaera* Jeffreys, 1880: 316, *nom. nud.*; 1882: 939. Northeast Atlantic. 1262-2004 m. **[*Cuspidaria*]**
bordaensis, *Verticordia* Cotton & Godfrey, 1938: 149, *nom. nov. pro Verticordia australiensis* Hedley, 1907, *non* E. A. Smith, 1885. Southwest Pacific. 16-549 m. **[*Verticordia*]**
boucheti, *Cetoconcha* Poutiers & Bernard *sp. nov.* West Central Pacific. 300-330 m. **[*Cetoconcha*]**
brachyrhynchus, *Cuspidaria* Sturany, 1901: 263. Red Sea. 375-2160 m. **[*Cuspidaria*]**
brazieri, *Neaera* E. A. Smith, 1885: 51. Southwest Pacific. 4-200 m. **[*Plectodon*]**
braziliensis, *Cetoconcha* Allen & Morgan, 1981: 521. Atlantic. 2250-3730 m. **[*Cetoconcha*]**
braziliensis, *Cuspidaria* E. A. Smith, 1915: 104. Southwest Atlantic. 72-100 m. **[*?Cuspidaria*]**
brevirostris, *Anatina* Brown, 1829: 11. = *Cuspidaria cuspidata* (Olivi, 1792)
brevirostris, *Austroneaera* Powell, 1937: 174. Southwest Pacific. 260 m. **[*Cuspidaria (Rhinoclama)*]**
brucei, *Cuspidaria* Melvill & Standen, 1907: 122. = *Cuspidaria undata* (Verrill, 1884)
bruuni, *Cardiomya* Dell, 1956a: 34. South Pacific. 610 m. **[*Cardiomya*]**
buccina, *Cuspidaria* (*Cuspidaria*) Bernard, 1989: 62. Northeast Pacific. 3585 m. **[*Cuspidaria*]**
bulla, *Lyonsia* Dall, 1878: 61, *nom. nud.*; 1881: 107. Northwest Atlantic. 3506-5860 m. **[*Cetoconcha*]**
butoni, *Poromya* (*Cetocoucha*) Prashad, 1932: 327. West Pacific. 70-535 m. **[*Poromya (Cetomya)*]**
buttoni, *Dermatomya* Dall, 1916a: 22, *nom. nud.*; 1916b: 406. Northeast Pacific. 119-1063 m. **[*Poromya (Dermatomya)*]**
caduca, *Cuspidaria* (*Myonera*) E. A. Smith, 1894: 170. Indo-Pacific. 50-1134 m. **[*Myonera (Rengea)*]**
caelata, *Verticordia* Verrill, 1882: 566. = *Trigonulina ornata* d'Orbigny, 1846
californica, *Cuspidaria* (*Cardiomya*) Dall, 1886b: 296. East Pacific. 15-640 m. **[*Cardiomya*]**
cambrica, *Vertisphaera* Iredale, 1930: 387-388. Southwest Pacific. 146 m. **[*Haliris (Vertispbaera)*]**
canadensis, *Poromya* (*Dermatomya*) Bernard, 1969: 2232. = *Poromya* (*Dermatomya*) *tenuiconcha* Dall, 1913
canariensis, *Cuspidaria* (*Myonera*) De Boer, 1985: 102. North Atlantic. 500-2300 m. **[*Myonera*]**
capensis, *Neaera* E. A. Smith, 1885: 45. Southeast Atlantic. 91-564 m. **[*Cuspidaria*]**
carinifera, *Verticordia* Locard, 1898: 208. East Central Atlantic. 2083 m. **[*Halicardia*]**
casta, *Neaera* Hinds, 1843: 77. West Central Pacific. 15 m. **[*Cardiomya*]**
castanea, *Poromya* Habe, 1952b: 156. Northwest Pacific. 30-880 m.**[*Poromya*]**
centobi, *Cuspidaria* Bouchet & Warén, 1979: 218. Northeast Atlantic, Arctic Ocean (*fide* KNUDSEN 1985). 2330-3700 m. **[*Myonera*]**
ceylonensis, *Cetoconcha* Knudsen, 1970: 119. Indian Ocean. 3310 m. **[*Cetoconcha*]**
chilensis, *Cuspidaria* (*Luzonia*) Dall, 1890: 282. Southeast Pacific. 1238-1895 m. **[*Cuspidaria (Luzonia)*]**
chilensis, *Poromya* (*Dermatomya*) Dall, 1908: 430. Southeast Pacific. 821 m. **[*Poromya (Dermatomya)*]**

Source : MNHN, Paris

chiuensis, *Neaera* Gray *in* Griffith & Pidgeon, 1834: 12 & 598. West Pacific. 100-250 m. **[*Cuspidaria*]**
chuni, *Cuspidaria* (*Cardiomya*) Thiele & Jaeckel, 1931: 257. Indian Ocean. 400-1134 m. **[*Cardiomya*]**
cinerea, *Neaera cuspidata* var. Jeffreys, 1865: 54. = *Cuspidaria cuspidata* (Olivi, 1792)
circinata, *Neaera* Jeffreys, 1876: 497. North and Central Atlantic. 564-4382 m. **[*Cuspidaria*]**
cistagemma, *Euciroa* Kuroda, 1952: 14. = *Euciroa crassa* Thiele & Jaeckel, 1931
clathrata, *Cuspidaria* (*Soyomya*) Poutiers & Bernard *sp. nov.* West Pacific. 230 m. **[*Cuspidaria (Soyomya)*]**
clavicnlata, *Neaera* Dall, 1881: 112. West Central Atlantic. 183-985 m. **[*Halonympha*]**
cleryana, *Sphaenia* d'Orbigny, 1842: 708, pl. 83, figs 16-18. Southwest Atlantic. 50-225 m. **[*Cardiomya*]**
cochinensis, *Cuspidaria* Preston, 1916a: 39. Indian Ocean. Shallow water. [Taxonomic status uncertain]
cochlearis, *Neaera* Hinds, 1844: 98. = *Leptomya cochlearis* (Hinds, 1844) [Semelidae]
colpodes, *Cuspidaria* Dautzenberg & Fischer, 1897b: 223. Azores, West Indian Ocean. 693-1644 m. **[*?Protocuspidaria (Bidentaria)*]**
compressa, *Lyonsiella* Allen & Turner, 1974: 458. Northeast Atlantic. 119 m. **[*Lyonsiella*]**
compressa, *Mytilimeria* Locard, 1898: 211. Not a *Halicardia* (see note 2 below).
concentrica, *Cuspidaria* Thiele, 1912: 233. Antarctic. 351 m. **[*Cuspidaria*]**
concinna, *Neaera* Hinds, 1843: 77. Habitat unknown. **[*Cardiomya*]**
congenita, *Neaera* E. A. Smith, 1885: 52. West Central Atlantic. 800 m. **[*Halonympha*]**
consimilis, *Cuspidaria nobilis* Habe, 1961: 146 & App.42. = *Cuspidaria nobilis* (A. Adams, 1864)
consociatu, *Neaera* E. A. Smith, 1885: 41. West Central Atlantic. 340-850 m. **[*Cuspidaria*]**
contracta, *Neaera* Jeffreys, 1882: 941. Northeast Atlantic. 1354-2967 m. **[*Cuspidaria*]**
convexa, *Cuspidaria* Pelseneer, 1911: 80. Tropical West Pacific. 100-694 m. **[*Cuspidaria*]**
convexa, *Cuspidaria* (*Cuspidaria*) Prashad, 1932: 329. = *Cuspidaria convexa* Pelseneer, 1911
cordata, *Lyonsiella* Verrill & Bush, 1898: 818. Northwest Atlantic. 2602-3338 m. **[*Policordia*]**
corpulenta, *Neaera costellata* var. Dall, 1881: 111. = *Cardiomya costellata* (Deshayes, 1833)
corrugata, *Cuspidaria* (*Cuspidaria*) Prashad, 1932: 329. Tropical West Pacific. 38-320 m. **[*Cuspidaria*]**
costatu, *Anatina* Sowerby, 1834: 87. Tropical East Pacific. 4-84 m. **[*Cardiomya*]**
costata, *Neaera* Bush, 1885: 472, *non* Sowerby, 1834. = *Cardiomya ornatissima* (d'Orbigny, 1846)
costellata, *Corbula* Deshayes, 1833: 86. North Atlantic, Mediterranean. 5-2000 m. **[*Cardiomya*]**
costeminens, *Verticordia* (*Spinosipella*) Poutiers, 1981: 351. Tropical West Pacific. 750-925 m. **[*Spinosipella*]**
cowani, *Cuspidaria* (*Cuspidaria*) Bernard, 1967: 2629. Northeast Pacific. 1318 m. **[*Cuspidaria*]**
crassa, *Euciroa* Thiele & Jaeckel, 1931: 248. Indo-Pacific. 136-1463 m. **[*Euciroa*]**
crebrilirata, *Verticordia* (*Verticordia*) Prashad, 1932: 324. Tropical West Pacific. 564 m. **[*Haliris*]**
cuneata, *Verticordia* (*Vertambitus*) Kuroda, 1952: 8. Northwest Pacific. 200 m. **[*Vertambitus*]**
curta, *Lyonsiella* Poutiers, 1984: 298. West Indian Ocean. 3700-3716 m. **[*Lyonsiella*]**
curta, *Neaera* Jeffreys, 1876: 495, *nom. nud.*; 1882: 943. Arctic, North Atlantic. 32-2338 m. **[*Cardiomya*]**
curta, *Neaera cuspidata* var. Jeffreys, 1865: 54. = *Cuspidaria cuspidata* (Olivi, 1792)
curta, *Neaera multicostata* var. Verrill, 1882: 560, *non Neaera curta* Jeffreys, 1882. = *Cardiomya striata* (Jeffreys, 1876)
curta, *Poromya* Sowerby, 1904: 17. Southwest Indian Ocean. 805 m. **[*Poromya*]**
cuspidata, *Neaera* Hinds, 1843: 76, *non* Olivi, 1792. Northwest Pacific. 154 m. *Nom. dub.*
cuspidata, *Tellina* Olivi, 1792: 101. Northeast & East Central Atlantic, Mediterranean. 20-1850 m. **[*Cuspidaria*]**
cymata, *Poromya* Dall, 1890: 289. Southwest Atlantic. 72-108 m. **[*Poromya*]**
dalli, *Euciroa* Pilsbry, 1911: 523. = *Euciroa eburnea* (Wood-Mason & Alcock, 1891)
dautzenbergi, *Myonera* Prashad, 1932: 334. Northwest Pacific to Indonesia. 715-959 m. **[*Myonera*]**
delectabile, *Euciroa* Dell, 1956b: 42. = *Euciroa galatheae* (Dell, 1956)
delli, *Cuspidaria* Knudsen, 1970: 141. Southwest Pacific. 4400 m. **[*Cuspidaria*]**

Source : MNHN, Paris

demistriata, *Cuspidaria* (*Myonera*) Allen & Morgan, 1981: 469. = *Bathyneaera hadalis* (Knudsen, 1970)
densicostata, *Verticordia* Locard, 1898: 202. Central Atlantic. 1002-2325 m. **[*Policordia*]**
depressa, *Neaera* Jeffreys, 1882: 940. East Atlantic, Mediterranean. 164-2351 m. **[*Halonympha*]**
deshayesiana, *Verticordia* Fischer, 1862: 35. Indo-Pacific. 40-693 m. **[*Spinosipella*]**
diagonalis, *Cuspidaria* (*Tropidonya*) Allen & Morgan, 1981: 487. Southeast Atlantic. 527-542 m. **[*Cuspidaria (Tropidonya)*]**
didyma, *Neaera* Hinds, 1843: 78. Tropical East Pacific. 18-48 m. **[*Cardionya*]**
dionedeu, *Policordia* Dall, Bartsch & Rehder, 1938: 217. Mid-North Pacific. 44-530 m. **[*Policordia*]**
disa, *Cardiomya* (*Labromysa*) Bernard, 1989: 64. Northeast and Northwest Pacific, tropical West Indian Ocean, tropical West Atlantic. 3700-6850 m. **[*Bathyneaera*]**
dispar, *Cuspidaria* (*Myonera*) Dall, Bartsch & Rehder, 1938: 225. Northwest & Mid-North Pacific. 400-914 m. **[*Myonera*]**
dissociata, *Cuspidaria* Sturany, 1901: 262. Red Sea. 805 m. **[*Cuspidaria*]**
dorsirecta, *Cuspidaria* Verco, 1908: 198. Southeast Indian Ocean, Southern Australia. 73-1150 m. **[*Cuspidaria (Rhinoclama)*]**
dubia, *Cuspidaria* (*Myonera*) Pelseneer, 1911: 80. Indo-Pacific. 200-2798 m. **[*Cuspidaria (Rhinoclama)*]**
dubia, *Cuspidaria* (*Rhinoclama*) Prashad, 1932: 333. = *Cuspidaria* (*Rhinoclama*) *dubia* (Pelseneer, 1911)
dulcis, *Cuspidaria* (*Cardionya*) Pilsbry & Lowe, 1932: 10. = *Cardiomya costata* (Sowerby, 1834)
eburnea, *Verticordia* (*Euciroa*) Wood-Mason & Alcock, 1891: 447. Indo-Pacific. 340-1500 m. **[*Euciroa*]**
ecuadoriana, *Cuspidaria* (*Cardiomya*) Olsson, 1961: 465. Tropical East Pacific. 55-146 m. **[*Cardiomya*]**
elegans, *Cribrosoconcha* Krylova, 1991: 135. Southeast Pacific, 218-575 m. **[*Cetoconcha*]**
elegans, *Neaera* Hinds, 1843: 76. Indo-Pacific. 13-200 m. **[*Cuspidaria*]**
elegantissima, *Euciroa* Dall, 1878: 61, *nom. nud.* = *Euciroa elegantissima* (Dall, 1881)
elegantissima, *Verticordia* Dall, 1881: 106. West Central Atlantic. 300-1500 m. **[*Euciroa*]**
elliptica, *Cuspidaria* (*Cuspidaria*) Di Geronimo, 1974: 157. Mediterranean. 2300 m. **[*?Cuspidaria*]**
elongata, *Poromya* (*Cetoconcha*) Dall, 1886b: 283. West Central Atlantic. 183-364 m. **[*Poromya (Cetomya)*]**
equatorialis, *Poromya* (*Dermatomya*) Dall, 1908: 429. = *Poromya (Dermatomya) inactroides* Dall, 1889
ericia, *Verticordia* Hedley, 1911: 96. South and Central Indo-Pacific. 146-805 m. **[*Spinosipella*]**
erma, *Cuspidaria* Cotton, 1931: 347. Southern Australia. 148-550 m. **[*Cuspidaria*]**
exarata, *Cuspidaria* Verco, 1908: 199. Southern Australia. 190 m. **[*Cuspidaria*]**
excoriata, *Verticordia* Poutiers, 1984: 297. West Indian Ocean. 3700 m. **[*Vertambitus*]**
exigua, *Cetoconcha* Poutiers & Bernard, *sp. nov.* West Pacific. 970 m. **[*Cetoconcha*]**
exigua, *Neaera* Jeffreys, 1876: 496. Arctic, North Atlantic. 640-1836 m. **[*Cuspidaria*]**
eximia, *Poromya* Pelseneer, 1911: 78. Indo-Pacific. 50-1190 m. **[*Poromya (Cetomya)*]**
eximia, *Poromya* (*Cetoconcha*) Prashad, 1932: 327. = *Poromya* (*Cetomya*) *eximia* Pelseneer, 1911
expansa, *Verticordia*? Prashad, 1932: 324. West Pacific. 835 m. **[*Verticordia*]**
extenta, *Policordia* (*Angustebranchia*) Ivanova, 1977: 182. Northwest Pacific. 8220-8430 m. **[*Policordia (Angustebranchia)*]**
fairchildi, *Cuspidaria* Suter, 1908: 372. Southwest Pacific. 137-640 m. **[*Cuspidaria*]**
fallax, *Neaera* E. A. Smith, 1885: 49. West Pacific. 283 m. **[*? Cardiomya (Karodamya)*]**
ferruginea, *Halicardia* Di Geronimo, 1974: 158. Mediterranean. 2300-2400 m. **[*Halicardia*]**
filatovae, *Cardiomya* Scarlato, 1972: 127. Northwest Pacific. 3350 m. **[*Cardiomya*]**
filatovae, *Cuspidaria* Bernard, 1979: 14. Northeast Pacific. 3500-4882 m. **[*Cuspidaria (Rhinoclama)*]**
filocarinata, *Neaera* E. A. Smith, 1885: 44. = *Cuspidaria* (*Rhinoclama*) *notabilis* (Jeffreys, 1876)
fiulayi, *Anstroneaera* Powell, 1937: 175. Southwest Pacific. 110 m. **[*Cuspidaria (Rhinoclama)*]**
fischeri, *Mytilimeria* Jeffreys, 1880: 316; 1881: 384. *Nom. nud.* = *Halicardia fischeri* (Locard, 1898)
fischeri, *Mytilimeria* Locard, 1898: 212 (*ex* Jeffreys MS). Northeast Atlantic, 1140-2650 m. **[*Hulicardia*]**

Source : MNHN, Paris

fischeriana, *Verticordia* Dall, 1881: 106. West Atlantic, East Pacific. 80-510 m. [***Haliris***]
flexuosa, *Mytilimeria* Verrill & Smith *in* Verrill, 1881: 302. North Atlantic. 137-2330 m. [***Hulicardia***]
flexuosa, *Poromya* Yokoyama, 1922: 173. Northwest Pacific. 30-350 m. [***Poromya***]
fluctuosa, *Myonera* Kuroda, 1948: 25.= *Myonera caduca* (E. A. Smith, 1894)
formosa, *Cuspidaria* Verrill & Bush, 1898: 803. Northwest Atlantic. 2173 m. [***Cuspidaria***]
formosa, *Lyonsia* Jeffreys, 1874: 112, *nom. nud.*; 1880: 316, *nom. nud.*; 1882: 930. Atlantic, Mediterranean; Indian Ocean & Pacific? (MORTON, 1985a) 366-3783 m. [? ***Lyonsiella***] (see note 3 below).
forticostata, *Cuspidaria* (*Cardiomya*) Sowerby, 1904: 18. Southwest Indian Ocean. 805 m. [***Cardiomya***]
fortisculpta, *Cuspidaria* (*Cardiomya*?) Kuroda, 1948: 20. Northwest Pacific. 100-200 m. [***Curdiomya (Kurodamya)***]
fragilis, *Lyonsiella* Allen & Turner, 1974: 456. North Atlantic. 1102-1470 m. [***Lyonsiella***]
fragilis, *Neaera* A. Adams, 1856: 226.= *Theora fragilis* (A. Adams, 1856) [Semelidae]
fragilissima, *Neaera* E. A. Smith, 1885: 53. Southwest Indian Ocean. 349 m. [***Cardiomya***]
fraterna, *Cuspidaria* Verrill & Bush, 1898: 803. Northwest Atlantic. 552-1800 m. [***Cuspidaria***]
frieli, *Lyonsiella* Allen & Turner, 1974: 440. North Atlantic. 3301-4429 m. [***Laevicordia***]
fujitai, *Cuspidaria* (*Cardiomya*) Kuroda, 1948: 18. Northwest Pacific. 100-300 m. [***Cardiomya***]
galatheae, *Cetoconcha* Knudsen, 1970: 120. Southwest Pacific. 4400 m. [***Cetoconcha***]
galatheae, *Laevicordia* Knudsen, 1970: 128. West Indian Ocean. 4820 m. [***Lacvicordia***]
galatheae, *Questimya* Dell, 1956a: 33. Southwest Pacific. 475-622 m. [***Euciroa***]
garretti, *Myonera* Dall, 1908: 434. Tropical East Pacific. 1644 m. [***Myoneru***]
gemma, *Cardiomya* Verrill & Bush, 1898: 809. = *Cardiomya costellata* (Deshayes, 1833)
gemma, *Lyonsiella* Verrill, 1880: 396. North Atlantic, Mediterranean. 73-3917 m. [***Policordia***]
gigantea, *Cuspidaria* (*Cuspidaria*) Prashad, 1932: 329. Indo-Pacific. 100-1030 m. [***Cuspidaria***]
gigantea, *Neaera* Verrill, 1884: 223. Northwest Atlantic. 2286-3506 m. [***Myonera***]
gilchristi, *Poromya* Sowerby, 1904: 15. Southwest Indian Ocean. 86-99 m. [***Poromya***]
gilchristi, *Cuspidaria* (*Cardiomya*) Sowerby, 1904: 18. Southwest Indian Ocean. 73-229 m. [***Cardiomya***]
glacialis, *Neaera* G. O. Sars, 1878: 88. Arctic, North Atlantic. 71-2500 m. [***Cuspidaria***]
globulosa, *Bathyneaera* Krylova, 1993: 55. North Atlantic. 4440-4480 m. [***Bathyneaera***]
gloriosa, *Poromya* (*Cetoconcha*) Prashad, 1932: 326. Tropical West Pacific. 150-400 m. [***Cetoconcha***]
glypta, *Cardiomya* Bush *in* Verrill & Bush, 1898: 810, *nom. nov. pro Neaera costata* Bush, 1885 *non* Sowerby, 1834. = *Cardiomya ornatissima* (d'Orbigny, 1846)
gouldi, *Halicardia* Dall, Bartsch & Rehder, 1938: 218. Mid-North Pacific. Depth unknown. [***Halicardia***]
gouldiana, *Neaera* Hinds, 1843: 77. West Pacific. 13-1030 m. [***Cardiomya***]
gracilis, *Cuspidaria* "(G. O. Sars)" NORDSIECK, 1969: 176. = *Cuspidaria gracilis* (Jeffreys, 1882)
gracilis, *Neaera* Jeffreys, 1882: 938. Arctic, Northeast Atlantic. 70-2032 m. [***Cuspidaria***]
granatina, *Poromya (?)* Dall, 1881: 109. = *Basterotia quadrata* (Hinds, 1843) [Sportellidae]
grandis, *Lyonsiella* E. A. Smith, 1885: 74. South Atlantic. 3470 m. [***Policordia***]
granifera, *Questimya* Cotton, 1931: 345. Southwest Pacific. 20-250 m. [***Euciroa***]
granosissima, *Poromya* Sowerby, 1904: 16. Southwest Indian Ocean. 49-165 m. [***Poromya***]
granulata, *Corbula?* Nyst & Westendorp, 1839: 6. North Atlantic, Mediterranean. 30-1262 m. [***Poromya***]
granulata, *Ectorisma* Tate, 1892: 127. = *Poromya laevis* E. A. Smith, 1885.
granulata, *Neaera* Dall, 1881: 111. West Central Atlantic. 37-274 m. [***Plectodon***]
granulata, *Verticordia* Seguenza, 1858: 356. North & Central Atlantic, Mediterranean. 55-1245 m. [***Haliris***]
granulifera, *Pecchiolia* Verrill, 1885: 434. Northwest Atlantic. 2450-3400 m. [***Verticordia***]
granuloderma, *Poromya granulodernia* Scarlato, 1981: 428. Northwest Pacific. 300-664 m. [***Poromya***]
greenii, *Cuspidaria* (*Cardiomya*) E. A. Smith, 1889: 423. Northeast Atlantic. 1829 m. [***Cardiomya***]
guineensis, *Cuspidaria* Knudsen, 1970: 143. East Central Atlantic. 2550 m. [?***Cuspidaria***]

Source : MNHN, Paris

guineensis, *Verticordia* Thiele & Jaeckel, 1931: 246. East Central Atlantic. 2278 m. **|*Verticordia*|**
haasi, *Cuspidaria* Knudsen, 1970: 145. Tropical East Pacific. 3570 m. **|*Cuspidaria*|**
hadalis, *Cuspidaria* Knudsen, 1970: 146. West Atlantic, tropical West Indian Ocean, West Pacific. 1135-8430 m. **|*Bathyneaera*|**
halei, *Cuspidaria* Cotton & Godfrey, 1938: 158. Southern Australia. 238-550 m. **|*Cuspidaria*|**
halimera, *Cuspidaria* (*Leiomya*) ((*Rhinoclama*)) Dall, 1886b: 300. North Atlantic. 1337-2934 m. **|*Cuspidaria (Rhinoclama)*|**
hancocki, *Verticordia* (*Trigonulina*) Bernard, 1969: 2233. Tropical East Pacific. 73-110 m. **|*Trigonulina*|**
hawaiensis, *Cuspidaria* (*Cuspidaria*) Dall, Bartsch & Rehder, 1938: 226. Mid-North Pacific. 468-874 m. **|*Cuspidaria*|**
hawaiensis, *Euciroa* " Dall, Bartsch & Redher " HABE, 1964: 212, *nom. null.* Error for *Euciroa gouldi* Dall, Bartsch & Rehder, 1938.
hayashii, *Poromya* Habe, 1958: 175, 180. Northwest Pacific. 50-200 m. **|*Poromya*|**
hindsiana, *Neaera* A. Adams, 1864: 207. Northwest Pacific. 50-200 m. **|*Cuspidaria*|**
hirasei, *Cuspidaria* Kuroda, 1948: 10. = *Cuspidaria steindachneri* Sturany, 1901
horrida, *Laevicordia* Allen & Turner, 1974: 507. Northeast Atlantic. 2862-2886 m. **|*Laevicordia*|**
houbricki, *Halicardia* Poutiers & Bernard *sp. nov.* Borneo. 1629 m. **|*Halicardia*|**
houbricki, *Poromya* (*Poromya*) Bernard, 1989: 65. Northeast Pacific. 95-100 m. **|*Poromya*|**
hyalina, *Neaera* Hinds (*ex* Sowerby MS), 1843: 76. Northwest Pacific. Depth unknown. **|*?Cuspidaria*|**
hyalina, *Poromya* (*Dermatomya*) Bernard, 1989: 66. Northeast Pacific. 4882 m. **|*Poromya (Dermatomya)*|**
illevis, *Poromya* Hedley, 1913: 265, *nom. nov. pro Ectorisma granulata* Tate, 1892 *non Poromya granulata* (Nyst & Westendorp, 1839). = *Poromya laevis* E.A. Smith, 1885
imbricata, *Neaera* Jeffreys, 1880: 316; 1881: 383; 1882: 942. *Nom. nud.* = *Cuspidaria iubricata* Locard, 1898
imbricata, *Cuspidaria* Locard (*ex* Jeffreys MS), 1898: 187. Northeast Atlantic. 1107-1960 m. **|*Cuspidaria*|**
indica, *Cetoconcha* Ray, 1951: 187. Indian Ocean. Depth unknown. **|*Cetoconcha*|**
infelix, *Cuspidaria* Thiele, 1912: 233. Antarctic. 91-752 m. **|*Cuspidaria*|**
inflata, *Neaera* Jeffreys, 1882: 942. North Atlantic. 1000-2000 m. **|*Cuspidaria (Leiomya)*|**
inornata, *Verticordia* Thiele & Jaeckel, 1931: 245. Southwest Indian Ocean. 49-229 m. **|*Verticordia*|**
insculpta, *Pecchiolia* Jeffreys, 1874: 112, *nom. nud.*; 1882: 932. = *Policordia gemma* (Verrill, 1880)
insculpta, *Verticordia* (*Laevicordia*) Seguenza, 1876a: 112. Mediterranean. Depth unknown. **|*Laevicordia*|**
insolita, *Policordia* Allen & Turner, 1974: 502. North Atlantic. 1546-2178 m. **|*Policordia*|**
intermedia, *Cetoconcha* (*eximia* var?) Habe, 1952b: 158. = *Poromya* (*Cetomya*) *eximia* Pelseneer, 1911
iridella, *Cuspidaria* (*Pseudoneaera*) Kuroda, 1948: 25. = *Pseudoneaera semipellucida* (Kuroda, 1948)
iridescens, *Neaera* Hinds, 1843: 78. = *Theora iridescens* (Hinds, 1843) [Semelidae]
isocardioides, *Poromya* (*Cetoconcha*) Dautzenberg & Fischer, 1897a: 30. = *Poromya tornata* (Jeffreys, 1876)
isolirata, *Cardiomya* Bernard, 1969: 2231. = *Cardiomya pectinata* (Carpenter, 1865)
iturupica, *Cardiomya* Scarlato, 1972: 127. Northwest Pacific. 414 m. **|*Cardiomya*|**
ivanovae, *Policordia* Poutiers & Bernard, *nom. nov. pro Policordia japonica* Ivanova, 1977, *non* Habe, 1961. Northwest Pacific. 3042 m. **|*Policordia*|**
jaffaensis, *Verticordia* Cotton & Godfrey, 1938: 151. Southwest Pacific. 183-549 m. **|*Haliris*|**
japonica, *Cetoconcha* Habe, 1952b: 159. West Pacific. 175-650 m. **|*Cetoconcha*|**
japonica, *Cuspidaria* Kuroda, 1948: 14. Northwest Pacific. 100-300 m. **|*Caspidaria*|**
japonica, *Lyonsiella* Habe, 1952a: 269, *nom. nud.*; 1961: 145 & App.41. = *Policordia pilula* (Pelseneer, 1911)
japonica, *Policordia* (*Latebranchia*) Ivanova, 1977: 193, *non* Habe, 1961. = *Policordia ivanovae* Poutiers & Bernard
japonica, *Verticordia* A. Adams, 1862: 224. = *Spinosipella deshayesiana* (Fischer, 1862)

Source : MNHN, Paris

jeffreysi, *Lyonsiella* Friele, 1879: 269. Northeast Atlantic, Arctic Ocean (*fide* KNUDSEN, 1985). 1198-4429 m. **[*Policordia*]**
jeffreysi, *Lyonsiella* E. A. Smith, 1885: 73, *non* Friele, 1879. = *Laevicordia smidti* (Friele, 1886)
jeffreysi, *Neaera* Dall, 1881: 111. Northwest & West Central Atlantic. 849-2022 m. **[*Cuspidaria*]**
jugosa, *Neaera* G. O. Sars, 1878: 88, *non* Wood, 1850. = *Cuspidaria lamellosa* (G. O. Sars, 1878)
jugosa, *Neaera* Wood, 1850: 272. Northeast Atlantic, Mediterranean. 200-1100 m. **[?*Cuspidaria*]**
kashiuana, *Cardiomya* Okutani & Sakurai, 1964: 20. Northwest Pacific. 200-1030 m. **[*Cardiomya*]**
kawamurai, *Cuspidaria* Kuroda, 1948: 11. = *Cuspidaria* (*Cuspidaria*) *gigantea* Prashad, 1932
kerguelensis, *Neaera* E. A. Smith, 1885: 46. Antarctic. 60-574 m. **[*Cuspidaria*]**
knudseni, *Cuspidaria* (*Cardiomya*) Allen & Morgan, 1981: 466. Southwest & North Atlantic. 1661-3806 m. **[*Cardiomya*]**
korenii, *Embla* Lovén, 1846: 200. = *Poromya granulata* (Nyst & Westendorp, 1839)
kurilensis, *Dermatomya* Scarlato, 1981: 427. = *Poromya* (*Dermatomya*) *tenuiconcha* Dall, 1913
kurodai, *Cuspidaria* Okutani, 1975a: 196. Northwest Pacific. 158-177 m. **[*Cuspidaria*]**
kurohijii, *Cuspidaria* Okutani, 1972: 126. Northwest Pacific. 130-190 m. **[*Cuspidaria (Soyomya)*]**
kyushuensis, *Cuspidaria* Okutani, 1962: 35. Northwest Pacific. 520-760 m. **[*Cuspidaria*]**
lactea, *Neaera costellata* var. Jeffreys, 1865: 50. = *Cardiomya costellata* (Deshayes, 1833)
laevigata, *Policordia* (*Angustebranchia*) Ivanova, 1977: 184. West Pacific. 8160-8900 m. **[*Policordia (Angustebrunchia)*]**
laevis, *Poromya* E. A. Smith, 1885: 55. South Pacific. 15-805 m. **[*Poromya*]**
lamellifera, *Neaera* Dall, 1881: 113. Northwest Atlantic. 153-457 m. **[*Myonera*]**
lamellosa, *Neaera* M. Sars, 1859: 62; 1869: 257. *Nom. nud.* = *Cuspidaria lamellosa* (G. O. Sars, 1878)
lamellosa, *Neaera* G. O. Sars, 1878 (*ex* M. Sars MS): 88. North Atlantic. 91-1015 m. **[*Cuspidaria*]**
lamothei, *Verticordia* Dautzenberg & Fischer, 1897a: 30. East Atlantic, West Indian Ocean. 126-608 m. **[*Haliris*]**
lamieri, *Cuspidaria* Strong & Hertlein, 1937: 163. East Central Pacific. 37-402 m. **[*Cardiomya*]**
lata, *Neaera* Hinds, 1843: 79. = *Theora lata* (Hinds, 1843) [Semelidae]
latesulcata, *Neaera* Tenison-Woods, 1878: 123. West Pacific. 30 m. **[*Cuspidaria*]**
laticella, *Myonera* Dall, 1886b: 305. West Atlantic. 3111 m. **[*Bathyneaera*]**
ledaeformis, *Cuspidaria* Dautzenberg & Fischer, 1897a: 29. Central Atlantic. 1300-1600 m. **[?*Halonympha*]**
leiomyoides, *Cuspidaria* Poutiers, 1981: 340. Tropical West Pacific. 415-510 m. **[*Halonympha*]**
leonina, *Dermatomya* Dall, 1916a: 22, *nom. nud.*; 1916b: 406. = *Poromya* (*Dermatomya*) *tenuiconcha* Dall, 1913
levifrons, *Cuspidaria* Cotton, 1930: 235. Southern Australia. 550 m. **[*Cardiomya (Kurodamya)*]**
ligula, *Cuspidaria* Yokoyama, 1922: 169. Northwest Pacific. 10-300 m. **[*Plectodon*]**
limatula, *Neaera* Dall, 1881: 112. Northwest & West Central Atlantic. 230-1000 m. **[*Myonera*]**
lindbergi, *Cardiomya* Scarlato, 1972: 125. = *Cardiomya gouldiana* (Hinds, 1843)
lisbethae, *Policordia* Knudsen, 1970: 132. East Central Atlantic. 2690 m. **[*Policordia*]**
lischkei, *Cuspidaria* (*Myonera*) E. A. Smith, 1891: 438. Northwest Pacific. 3429 m. **[*Myonera*]**
longirostris, *Anatina* Lamarck, 1818: 463. = *Cuspidaria rostrata* (Spengler, 1793)
lubungensis, *Cuspidaria* Poutiers, 1981: 348. Tropical West Pacific. 191-195 m. **[*Cuspidaria*]**
lucifuga, *Cuspidaria* P. Fischer, 1887: 1155, *nom. nud.*; Locard, 1898: 184. = *Cuspidaria undata* (Verrill, 1884)
lyrata, *Neaera* Hinds, 1844: 97. = *Raeta lyrata* (Hinds, 1844) [Mactridae]
macrorhynchus, *Cuspidaria* E. A. Smith, 1895: 12. Indo-Pacific. 400-1190 m. **[*Cuspidaria*]**
mactroides, *Poromya* (*Dermatomya*) Dall, 1889: 448. East Pacific. 637-3060 m. **[*Poromya (Dermatomya)*]**
maculata, *Policordia* (*Angustebranchia*) Ivanova, 1977: 184. West Pacific. 9000-9050 m. **[*Policordia (Angustebranchia)*]**
magnifica, *Lyonsiella* Dall, 1913: 595. Tropical East Pacific. 115-300 m. **[*Lyonsiella*]**

Source : MNHN, Paris

major, *Cuspidaria rostrata* var. Dautzenberg & Fischer, 1897b: 220. = *Cuspidaria rostrata* (Spengler, 1793)
makiyamai, *Verticordia* (*Haliris*) Habe *in* Kuroda, 1952: 10. = *Haliris* (*Setaliris*) *pygmaea* (Kuroda, 1952)
malespinae, *Cetocoucha* Dall, 1916a: 22, *nom. nud.*; 1916b: 407. = *Poromya* (*Cetomya*) *malespinae* Ridewood, 1903
mulespinae, *Poromya* Ridewood, 1903: 272. Northeast Pacific. 2104-2871 m. **[*Poromya (Cetomya)*]**
maoria, *Halicardia* Dell, 1978: 162. Southwest Pacific. 676-713 m. **[*Halicardia*]**
murgurita, *Poromya* (*Cetoconcha*) Dall, 1886b: 284. West Central Atlantic. 715-1864 m. **[*Cetoconcha*]**
marmorea, *Cuspidaria* (*Rhinoclama*) Bernard, 1989: 64. = *Cuspidaria* (*Rhinoclama*) *filatovae* (Bernard, 1979)
maxima, *Cuspidaria* Dautzenberg & Fischer, 1897a: 28. East Atlantic. 1850-3200 m. **[*Cuspiduria*]**
media, *Cuspidaria* Verrill & Bush, 1898: 800. Northwest Atlantic. 115-283 m. **[*Cuspidaria*]**
media, *Lyonsiella* Okutani, 1962: 30. = *Policordia pilula* (Pelseneer, 1911)
mediopacifica, *Euciroa* Kosuge, 1979: 35. Central Pacific. 170-370 m. **[*?Euciroa*]**
meridionalis, *Neaera* E. A. Smith, 1885: 43. South Indian Ocean. 3566 m. **[*Cuspidaria*]**
mexicana, *Myonera* Knudsen, 1970: 134. East Pacific. 2110-3557 m. **[*Myonera*]**
microdonta, *Poromya* (*Cetomya*) Dall, 1890: 290. = *Poromya tornata* (Jeffreys, 1876)
microrhina, *Cuspidaria rostrata* var. Dall, 1886b: 295. Northwest Atlantic. 183-931 m. **[*Cuspidaria*]**
millegeminata, *Euciroa* Kuroda & Habe *in* Kuroda, 1952: 14. West Pacific. 100-365 m. **[*Euciroa*]**
minor, *Pseudoneaera* Thiele & Jaeckel, 1931: 258. West Indian Ocean. 50 m. **[*Pseudoneaera*]**
mitis, *Cuspidaria* (*Cuspidaria*) Prashad, 1932: 328. Indo-Pacific. 500-1620 m. **[*Cuspidaria*]**
moeshimaensis, *Verticordia* (*Haliris*) Habe, 1953: 133. = *Haliris multicostata* (A. Adams, 1862)
moluccana, *Neaera* Adams & Reeve, 1850: 84. = *Cuspidaria elegans* (Hinds, 1843)
monosteira, *Cuspidaria* (?) Dall, 1890: 281. West Central Atlantic. 850-1864 m. **[*Verticordia*]**
morelandi, *Cuspidaria* Dell, 1956b: 39. South Pacific. 238-549 m. **[*Cuspiduria*]**
morioria, *Cuspidaria* Dell, 1956b: 40. South Pacific. 238 m. **[*?Cuspidaria*]**
morrisae, *Cuspidaria* Poutiers & Bernard *sp. nov.* West Pacific. 230 m. **[*Cuspidaria*]**
multicarinata, *Cuspidaria* (*Cardiomya*) Prashad, 1932: 322. = *Cardiomya alcocki* (E. A. Smith, 1894)
multicostata, *Neaera* Verrill & Smith *in* Verrill, 1880: 398. = *Cardiomya striata* (Jeffreys, 1876)
multicostata, *Verticordia* A. Adams, 1862: 224. West Pacific. 50-450 m. **[*Haliris*]**
murrayi, *Lyonsiella* Knudsen, 1967: 297. West Indian Ocean. 1207-1463 m. **[*Policordia*]**
murrayi, *Neaera* E. A. Smith, 1885: 319. Mid-North Pacific. 5304 m. **[*Myonera (Rengea)*]**
nasuta, *Cuspidaria* Sowerby, 1904: 16, *non* A. Adams, 1864. = *Cuspidaria capensis* (E. A. Smith, 1885)
nasuta, *Neaera* A. Adams, 1864: 207. Northwest Pacific. 100-150 m. **[*Cuspidaria*]**
natalensis, *Cuspidaria* Knudsen, 1970: 148. Southwest Indian Ocean. 2640 m. **[*Cuspidaria*]**
neaeroides, *Poromya* Seguenza, 1876b: 270. North and Central Atlantic, Mediterranean. 208-1350 m. **[*Poromya*]**
neozelanica, *Ectorisina* Dell, 1956b: 43. South Pacific. 549 m. **[*Poromya*]**
niusensis, *Poromya* Thiele & Jaeckel, 1931: 252. East Indian Ocean. 660 m. **[*? Poromya (Cetomya)*]**
nipponensis, *Halicardia* Okutani, 1957: 30. Northwest Pacific. 400-1500 m. **[*Halicardia*]**
nipponica, *Cuspidaria* (*Cardiomya*) *abyssicola* Okutani, 1962: 35. Northwest Pacific. 360-1480 m. **[*Cardiomya*]**
nitens, *Cuspidaria* Locard, 1898: 181. Northeast Atlantic. 905-2200 m. **[*Cuspidaria (Rhinoclama)*]**
nitida, *Poromya* Adams & Reeve, 1850: 43. = *Leptomya nitida* (Adams & Reeve, 1850) [Semelidae]
nitida, *Thracia* Verrill, 1884: 221. = *Cetocoucha bulla* (Dall, 1881)
nobilis, *Neaera* A. Adams, 1864: 207. West Pacific. 50-300 m. **[*Cuspidaria*]**
notabilis, *Neaera* Jeffreys, 1876: 497. Northeast & East Central Atlantic. 1100-4734 m. **[*Cuspidaria (Rhinocluma)*]**
novemcostatus, *Hippagus* Adams & Reeve, 1850: 76. =? *Trigonulina ornata* d'Orbigny, 1846
nybelini, *Cuspidaria* Odhner, 1960: 381. = *Cuspidaria nudata* (Verrill, 1884)

Source : MNHN, Paris

oahuensis, *Policordia* "Dall, 1895" HIGO & GOTO, 1993: 679. = *Allogramma oahuensis* (Dall, 1913) [?Lyonsiidae]
obesa, *Neaera* Lovén, 1846: 202. Arctic, North Atlantic. 73-4453 m. **[*Cuspidaria*]**
obliqua, *Cuspidaria* (*Cardiomya*) De Boer, 1985: 101. North Atlantic. 60-245 m. **[*Cardiomya*]**
obliqueovata, *Policordia* (*Latebrauchia*) Ivanova, 1977: 189. West Pacific. 1100-1640 m. **[*Policordia*]**
obtusirostris, *Cuspidaria* Okutani, 1962: 34. Northwest Pacific. 620-1640 m. **[*Cuspidaria*]**
occidua, *Cuspidaria* Cotton, 1931: 347. Southern Australia. 132-148 m. **[*Cuspidaria*]**
ochotensis, *Cardiomya* Scarlato, 1972: 125. Northwest Pacific. 144-207 m. **[*Cardiomya*]**
ochotensis, *Poromya granuloderma* Scarlato, 1981: 429. = *Poromya granuloderma* Scarlato, 1981
ochotica, *Policordia* Scarlato, 1981: 419. West Pacific. 660 m. **[*Policordia (Dallicordia)*]**
octaporosa, *Cuspidaria* (*Myonera*) Allen & Morgan, 1981: 476. North Atlantic. 3459-5000 m. **[*Octoporia*]**
okezoko, *Cuspidaria* Okutani, 1985: 146. Northwest Pacific. 400 m. **[*Cuspidaria*]**
okutanii, *Cardiomya behringensis* Scarlato, 1972: 122. = *Cardiomya behringensis* (Leche, 1883)
olivacea, *Policordia* Poutiers *sp. nov.* Tropical West Pacific. 980-1080 m. **[*Policordia*]**
oldroydi, *Cuspidaria* (*Cardiomya*) Dall *in* Oldroyd, 1924: 33. = *Cardiomya pectinata* (Carpenter, 1864)
opalina, *Neaera* Hinds, 1843: 78. = *Theora opalina* (Hinds, 1843) [Semelidae]
optima, *Cuspidaria* Sowerby, 1904: 17. Southwest Indian Ocean. 44-564 m. **[*Cuspidaria*]**
optima, *Verticordia* Sowerby, 1894a: 39. = *Euciroa eburnea* (Wood-Mason & Alcock, 1891)
orbiculata, *Verticordia* (*Laevicordia*) Seguenza, 1876a: 112. Mediterranean. Depth unknown. **[*Laevicordia*]**
oregonensis, *Poromya* Ridewood, 1903: 274. *Nom. dub.*
orientalis, *Cuspidaria* (*Cardiomya*) Thiele & Jaeckel, 1931: 257. Indian Ocean. 50 m. **[*Cardiomya*]**
orientalis, *Poromya* Thiele & Jaeckel, 1931: 251. West Indian Ocean. 693-1644 m. **[*Poromya (Cetomya)*]**
ornata, *Trigonulina* d'Orbigny, 1846: 292. West Atlantic, East Pacific. 18-850 m. **[*Trigonulina*]**
ornatissima, *Sphena* d'Orbigny *in* de la Sagra, 1846: 286. West Atlantic. 34-620 m. **[*Cardiomya*]**
ovata, *Policordia* (*Latebrauchia*) Ivanova, 1977: 191. West Pacific. 5740-6040 m. **[*Policordia*]**
pacifica, *Euciroa* Dall, 1895b: 688. Mid-North Pacific. 435-910 m. **[*Euciroa*]**
pacifica, *Lyonsiella* Dall, 1908: 428. Mid Pacific. 2090 m. **[*Laevicordia*]**
paleifera, *Bathyneaera* Krylova, 1993: 57. Tropical West Atlantic. 6800-8330 m. **[*Bathyneaera*]**
pailoloana, *Cuspidaria* (*Myonera*) Dall, Bartsch & Rehder, 1938: 225. Mid-North Pacific. 506-604 m. **[*Myonera*]**
panamensis, *Cuspidaria* Dall, 1908: 432. Tropical East Pacific. 915-1281 m. **[*Cuspidaria*]**
papyracea, *Lyonsiella* E. A. Smith, 1885: 73. Southeast Indian Ocean. 3562 m. **[*Policordia*]**
papyria, *Neaera* Jeffreys, 1876: 498. Northeast Atlantic. 2652 m. **[?*Cuspidaria*]**
parapodema, *Cuspidaria* Bernard, 1969: 2232. East Pacific. 53-320 m. **[*Cuspidaria*]**
parkeri, *Cuspidaria* Knudsen, 1970: 150. Tropical East Pacific. 2790-2817 m. **[*Cuspidaria*]**
parthenopaea, *Cuneigia* Tiberi, 1855: 10. = *Poromya granulata* (Nyst & Westendorp, 1839)
parva, *Cuspidaria* Verrill & Bush, 1898: 801. North & Central Atlantic. 257-4659 m. **[*Cuspidaria*]**
parva, *Lyonsiella* Okutani, 1962: 29. Northwest Pacific. 1230-1350 m. **[*Lyonsiella*]**
patagonica, *Neaera* E. A. Smith, 1885: 39. Southeast Pacific. 302 m. **[*Cuspidaria*]**
paucistriata, *Myonera* Dall, 1886b: 302. Atlantic. 600-3806 m. **[*Myonera*]**
paucistriata, *Neaera* "Dall" Bush, 1885: 473, *nom. nud.* = *Cardiomya gemma* Verril & Bush, 1898
pectinata, *Neaera* Carpenter, 1864: 602, 637, *nom. nud.*; 1865: 54. East Pacific. 45-210 m. **[*Cardiomya*]**
pellucida, *Neaera* Stimpson, 1853: 21. Northwest Atlantic. 95-944 m. **[*Cuspidaria*]**
pelseneeri, *Cetoconcha* Pelseneer, 1911: 79. Habitat unknown. **[*Cetoconcha*]**
pergranosa, *Poromya* Pelseneer, 1911: 78. = *Poromya australis* E. A. Smith, 1885
pergranosa, *Poromya* (*Poromya*) Prashad, 1932: 326. = *Poromya australis* E. A. Smith, 1885
periplomoides, *Cuspidaria* Sakurai & Habe *in* Habe, 1961: 146 & App. 41. Northwest Pacific. 200 m. **[?*Pseudoneaera*]**
perla, *Poromya* Dall, 1908: 428. Northeast Pacific. 2071-3518 m. **[*Perlaporomya*]**

Source : MNHN, Paris

perplexa, *Lyonsiella* Allen & Turner, 1974: 437. West Atlantic. 2041-4429 m. [***Lyonsiella***]
perplicata, *Verticordia* Dall, 1890: 278. East Pacific. 1000-1500 m. [***Halicardia***]
perrostrata, *Neaera ornatissima* var. Dall, 1881: 110. West Atlantic. 35-761 m. [***Cardiomya***]
persculpta, *Cuspidaria* (*Cardiomya*) Prashad, 1932: 332. = *Cardiomya alcocki* (E. A. Smith, 1894)
perversa, *Verticordia* Dall, 1886b: 289. Northwest Atlantic. 1337 m. [***Verticordia***]
philippinensis, *Halicardia* Poutiers, 1981: 353. Tropical West Pacific. 592-610 m. [***Halicardia***]
philippineusis, *Neaera* (*Rhinomya*) A. Adams, 1864: 207, *nom. nud.*; *non Neaera philippinensis* Hinds, 1843. = *Cuspidaria* (*Rhinoclama*) *adamsi* Heppell & Morgan, 1981
philippinensis, *Neaera* Hinds, 1843: 78. West Pacific. 36-55 m. [***Caspidaria (Luzonia)***]
pilula, *Lyonsiella* Pelseneer, 1911: 76. West Pacific, Gulf of Alaska (IVANOVA, 1977). 100-2980 m. [***Policordia***]
pilula, *Lyonsiella* Prashad, 1932: 325. = *Policordia pilula* (Pelseneer, 1911)
pinna, *Cuspidaria* (*Cardiomya*) Verco, 1908: 200. Southern Australia. 220-549 m. [***Cardiomya***]
planetica, *Cuspidaria* (*Cardiomya*) Dall, 1908: 433. East Pacific. 25-3000 m. [***Cardiomya***]
planulata, *Lysonsiella* Thiele, 1912: 232. = *Lyonsia arcaeformis* Martens, 1885 [Lyonsiidae]. See DELL (1990: 63)
platensis, *Neaera* E. A. Smith, 1885: 45. Southwest Atlantic. 100-1100 m. [***Caspidaria***]
plicata, *Cuspidaria* Thiele, 1912: 233. = *Cuspidaria tenella* E. A. Smith, 1907
podobeda, *Octoporia* Krylova, 1994b: 42. Southeast Pacific, 2140 m. [***Octoporia***]
polpodes, *Cuseidaria* (*sic*) Dautzenberg & Fischer, 1897a: 28, *nom. null.* Error for *Cuspidaria colpodes* Dautzenberg & Fischer, 1897
potti, *Cuspidaria* (*Cardiomya*) Sturany, 1901: 264. = *Cardiomya alcocki* (E. A. Smith, 1894)
pretiosa, *Myonera* (?) Verrill & Bush, 1898: 812. Northwest Atlantic. 618 m. [? ***Myonera***]
prolatissima, *Cuspidaria* Poutiers, 1981: 348. Tropical West Pacific. 170-407 m. [***Caspidaria***]
pseustes, *Cuspidaria* (*Cardiomya*) Dall, 1908: 432. = *Cardiomya planetica* (Dall, 1908), *fide* E. COAN (*in litt.* 1992)
pulchella, *Neaera* (*Cardiomya*) H. Adams, 1871: 789. = *Cardiomya singaporensis* (Hinds, 1843)
pulchella, *Poromya* Adams & Reeve, 1850: 83. = *Raeta* (*Raetellops*) *pulchella* (Adams & Reeve, 1850) [Mactridae]
pygmaea, *Verticordia* (*Haliris*) Kuroda, 1952: 10. Northwest Pacific. 30-200 m. [***Haliris (Setaliris)***]
quadrata, *Lyonsiella* Hedley, 1907a: 303. Southwest Pacific. 146 m. [***Lyonsiella***]
qaadrata, *Verticordia* Dall, 1886b: 290. Atlantic. 630-4980 m. [***Verticordia***]
quadrostrata, *Myonera angularis* Poutiers, 1984: 292. West Indian Ocean. 3700-3716 m. [***Bathyneaera***]
quaylei, *Lyonsiella* Bernard, 1969: 2232. East Pacific. 350-1800 m. [***Lyonsiella***]
radiata, *Anatina* Calcara, 1840: 40. = *Cardiomya* costellata (Deshayes, 1833)
radiata, *Lyonsiella* Dall, 1889: 442, *nom. nud.*; 1890: 276. Southeast Pacific. 675-821 m. [***Policordia***]
raoulensis, *Austroneaera* Powell, 1958: 78. Southwest Pacific. 75-85 m. [***Cuspidaria (Rhinoclama)***]
rara, *Cuspidaria* Thiele & Jaeckel, 1931: 253. = *Cuspidaria optima* Sowerby, 1904
rectangalata, *Policordia* (*Angustebranchia*) Ivanova, 1977: 180. West Pacific. 8175-9380 m. [***Policordia (Angustebranchia)***]
rectimarginata, *Cardiomya* Dell, 1962: 69. South Pacific. 550 m. [***Cardiomya***]
renovata, *Neaera* Tiberi, 1855: 9. = *Cuspidaria rostrata* (Spengler, 1793)
reticulata, *Cuspidaria* (*Cardiomya*) Kuroda, 1948: 19. Northwest Pacific. 100-800 m. [***Cardiomya***]
rhomboidea, *Verticordia* Hedley, 1906b: 72, *non* Tate, 1887. = *Haliris* (*Setaliris*) *setosa* (Hedley, 1907)
robiginosa, *Cardiomya* Okutani & Sakurai, 1964: 23. = *Cardiomya behringensis* (Leche, 1883)
romancheusis, *Porotrya* Odhner, 1960: 374. = *Poromya tornata* (Jeffreys, 1876)
ros, *Cuspidaria* (*Halonympha*) Verco, 1908: 201. Southern Australia. 235-550 m. [***Halonympha***]
rosea, *Neaera* Hinds, 1843: 78. West Pacific. 9-55 m. [***Caspidaria***]
rostra, *Myonera* Poutiers & Bernard *sp. nov.* West Central Pacific. 280-440 m. [***Myonera***]
rostrata, *Euciroa* (*Acreuciroa*) Thiele & Jaeckel, 1931: 249. West Pacific and East Indian Ocean. 200-550 m. [***Acreuciroa***]
rostrata, *Mya* Spengler, 1793: 42. Arctic, North and Central Atlantic. 18-2997 m. [***Caspidaria***]

Source : MNHN, Paris

rostrata, *Poromya* Rehder, 1943: 189. Northwest & West Central Atlantic. 110-183 m. **[*Poromya*]**
rostratocostellata, *Corbula* Acton, 1855: 3. = *Cardiomya costellata* (Deshayes, 1833)
rotundata, *Poromya* Jeffreys, 1876: 494. = *Poromya granulata* (Nyst & Westendorp, 1839)
rugata, *Neaera (Rhinomya)* Angas, 1867: 914, *non* A. Adams, 1864. = *Plectodon brazieri* (E.A. Smith, 1885)
rugata, *Neaera* (*Rhinomya*) A. Adams, 1864: 207. Northwest Pacific. 46 m. **[*Cuspidaria (Rhinoclama)*]**
ruginosa, *Neaera* Jeffreys, 1882: 942. East Atlantic. 250-3400 m. **[*?Protocuspidaria (Edentaria)*]**
rugosa, Octoporia Krylova, 1994b: 44. Southern Australia. 5020 m. **[*Octoporia*]**
saha, *Cardiomya* Knudsen, 1982: 133. West Central Atlantic. 235 m. **[*Cardiomya*]**
sadoensis, *Cuspidaria* Okutani & Ito, 1983: 167. Northwest Pacific. 200-275 m. **[*Cuspidaria*]**
sagamiana, *Cardiomya* Okutani & Sakurai, 1964: 21. = *Cardiomya tosaensis* (Kuroda, 1948)
sagamiensis, *Dermatomya tenuiconcha* Okutani, 1962: 32. = *Poromya* (*Dermatomya*) *tenuiconcha* Dall, 1913
saharica, *Mytilimeria* Locard, 1898: 213. East Central Atlantic. 1495 m. **[*Halicardia*]**
salauensis, *Cuspidaria* Thiele & Jaeckel, 1931: 254. West Indian Ocean. 404 m. **[*Hulonympha*]**
sansibarica, *Poromya* Thiele & Jaeckel, 1931: 251. West Indian Ocean. 404-463 m. **[*Poromya*]**
sarsii, *Silenia* E. A. Smith, 1885: 75. Southwest Atlantic, Southeast Indian Ocean. 3566-4846 m. **[*Cetoconcha*]**
scaber, *Plectodon* Carpenter, 1866: 207. East Pacific. 20-250 m. **[*Plectodon*]**
scapha, *Cetoconcha* Dall, 1902: 561. Tropical East Pacific. 183 m. **[*Poromya (Cetomya)*]**
seguenzae, *Verticordia* Dall, 1886b: 290. West Atlantic. 227-1170 m. **[*Verticordia*]**
semicostata, *Cuspidaria* (*Cardiomya*) Prashad, 1932: 333. Tropical West Pacific. 411 m. **[*Cardiomya (Kurodaina)*]**
semipellucida, *Cuspidaria* (*?Plectodon*) Kuroda, 1948: 24. Northwest Pacific. 100-250 m. **[*Pseudoneaera*]**
semirostrata, *Cuspidaria* Locard, 1898: 177. Atlantic. 2030-3175 m. **[*Cuspidaria*]**
semistrigosa, *Neaera* Jeffreys, 1882: 941. Northeast and tropical Atlantic. 330-1220 m. **[*Cuspidaria (Rhinoclama)*]**
septentrionalis, *Cuspidaria* (*Cardiomya*) *gouldiana* Kuroda, 1948: 18. = *Cardiomya gouldiana* (Hinds, 1843)
setosa, *Verticordia* Hedley, 1907a: 303, *nom. nov. pro Verticordia rhomboidea* Hedley, 1906, *non* Tate, 1887. Southwest Pacific. 146-293 m. **[*Haliris (Setaliris)*]**
sibogai, *Cuspidaria* (*Cardiomya*) Prashad, 1932: 331. Indonesia. 2060 m. **[*Cardiomya*]**
similima, *Cuspidaria* (*Cardiomya*) E. A. Smith, 1915: 104. = *Cardiomya cleryana* (d'Orbigny, 1845)
simila, *Rhinoclama* (*Austroneaera*) Krylova, 1994a: 61. Southeast Pacific. 380-570 m. **[*Cuspidaria (Rhinoclama)*]**
simplex, *Cuspidaria* (*Luzonia*) Allen & Morgan, 1981: 485. East Central Atlantic. 619-2357 m. **[*Cuspidaria (Luzonia)*]**
simplis, *Protocuspidaria* (*Edentaria*) Allen & Morgan, 1981: 498. North Atlantic. 1624-4825 m. **[*Protocuspidaria (Edentaria)*]**
simulans, *Cuspidaria* Tate, 1897: 44. Southern Australia. 75-275 m. **[*Cuspidaria (Rhinoclama)*]**
singaporensis, *Neaera* Hinds, 1843: 77. Indo-Pacific. 10-200 m. **[*Cardiomya*]**
sinica, *Cardiomya* Xu, 1980: 338. Northwest Pacific. 104-220 m. **[*Cardiomya*]**
sinuosa, *Octoporia* Krylova, 1994b: 40. Northwest, Southern Australia. 4440-5540 m. **[*Octoporia*]**
sinuosa, *Pecchiolia* Jeffreys, 1882: 932. North Atlantic, Mediterranean. 1200-2500 m. **[*Laevicordia*]**
smidti, *Lyonsiella* Friele, 1886: 38, *nom. nov. pro Lyonsiella jeffreysi* E. A. Smith, 1885, *non* Friele, 1879. Atlantic. 3300-4400 m. **[*Laevicordia*]**
smithi, *Lyonsiella* Dautzenberg, 1927: 348, *nom. nov. pro Lyonsiella jeffreysi* E. A. Smith, 1885, *non* Friele, 1879. = *Laevicordia smidti* (Friele, 1886)
smithi, *Lyonsiella* Prashad, 1932: 325, *non* Dautzenberg, 1927. = *Laevicordia abscissa* (Pelseneer, 1911)
smithii, *Cetoconcha* Dall, 1908: 431. East Central & Southeast Pacific. 302-3436 m. **[*Cetoconcha*]**

Source : MNHN, Paris

smithii, *Vulcanomya* Dall, 1886b: 299, *nom. nov. pro Neaera adunca* E.A. Smith, 1885 *non* Gould, 1861. Habitat unknown. **[*Cuspidaria (Vulcanomyu)*]**

solidula, *Cuspidaria (Cuspidaria)* Prashad, 1932: 330. Tropical West Pacific. 522 m. **[*Cuspidaria*]**

soyoae, *Poromya* (*Dermatomya*) Habe, 1952a: 274, *nom. nud.* = *Dermatomya tenuiconcha* var. *soyoae* Habe, 1952b

soyoae, *Dermatomya tenuiconcha* var. Habe, 1952b: 158. = *Poromya* (*Dermatomya*) *tenuiconcha* Dall, 1913

spinosa, *Euciroa* Thiele & Jaeckel, 1931: 249. West Indian Ocean. 404-463 m. **[*Euciroa*]**

spinosa, *Verticordia* (*Haliris*) Bernard, 1969: 2233. Tropical East Pacific. 275 m. **[*Haliris*]**

spinulosa, *Poromya* Thiele, 1912: 232. Antarctic. 300-400 m. **[*Poromya*]**

steindachneri, *Cuspidaria* Sturany, 1901: 261. Indo-Pacific. 106-1308 m. **[*Cuspidaria*]**

striata, *Neaera* Jeffreys. 1876: 495. Atlantic. 150-2650 m. **[*Cardiomya*]**

striata, *Poromya* Sowerby, 1904: 16. South Africa. 97-384 m. **[*Poromya*]**

striatella, *Halonympha* Verrill & Bush, 1898: 810. West Atlantic. 618-760 m. **[*Halonympha*]**

strioluta, *Cuspidaria* Locard, 1898: 195. Northeast Atlantic, Mediterranean. 322-2100 m. **[*Cardiomya*]**

subglacialis, *Cuspidaria* Dall, 1913: 593. Northeast Pacific. 2000 m. **[*Cuspidaria*]**

sublevis, *Poromya* Verrill, 1884: 221. = *Poromya tornata* (Jeffreys, 1876)

subrotundata, *Policordia* (*Latebranchia*) Ivanova, 1977: 192. North Pacific. 1050 m. **[*Policordia*]**

subquadrata, *Pecchiolia* Jeffreys, 1882: 932. North Atlantic. 298-3340 m. **[*Lyonsiellu*]**

suhtorta, *Neaera* G. O. Sars, 1878: 87. Arctic, North Atlantic. 0-990 m. **[*Cuspidaria*]**

sugauumai, *Cuspidaria* Nomura, 1940: 101. Northwest Pacific. 106-220 m. **[*Cuspidaria*]**

sulcata, *Corbula* Wood, 1840: 243, *nom. nud.* = *Cuspidaria jugosa* (Wood, 1850)

sulcata, *Neaera* Lovén, 1846: 202. = *Cardiomya costellata* (Deshayes, 1833)

sulcifera, *Neaera* Jeffreys, 1880: 316, *nom. nud.*; 1882: 937. Northeast Atlantic. 80-1250 m. **[*Cuspidaria*]**

sumatrana, *Poromya* Thiele & Jaeckel, 1931: 252. East Indian Ocean. Depth unknown. **[*Poromya*]**

surinamensis, *Cardiomya* Altena. 1971: 78. West Central Atlantic. 6-95 m. **[*Cardiomya*]**

tanabensis, *Plectodon* (*Pseudoneaera*) Habe, 1960: 288. = *Cuspidaria (Leiomya) adunca* (Gould, 1861)

tasmanica, *Cuspidaria* Knudsen, 1970: 152. Southwest Pacific. 4400 m. **[*Myonera*]**

tasmunica, *Neaera* Tenison-Woods, 1876: 27. Southern Australia. (*fide* TATE, 1897: 44). **[?*Pseudoneaera*]**

tenellu, *Cuspidaria* E. A. Smith, 1907: 1. Antarctic. 183-1674 m. **[*Cuspidaria*]**

tenerriua, *Verticordia* Thiele & Jaeckel, 1931: 246. West Indian Ocean. 463 m. **[*Verticordia*]**

tenuiconcha, *Poromya* (*Dermatomya*) Dall, 1913: 596. Northeast & Northwest Pacific. 100-2200 m. **[*Poromya (Dermatomya)*]**

tenuis, *Neaera* Hinds, 1844: 97. = *Raeta (Raetella) tenuis* (Hinds, 1844) [Mactridae]

tenuissima, *Cetoconcha* Okutani, 1966: 9. Northwest Pacific, 500-1000 m. **[*Cetoconcha*]**

teporis, *Haliris* Poutiers & Bernard, *sp. nov.* West Pacific. 390 m. **[*Haliris*]**

teramachii, *Cuspidaria* Kuroda, 1948: 14. Northwest Pacific. 100 m. **[*Cuspidaria*]**

teramachii, *Euciroa* (*Acreuciroa*) Kuroda, 1952: 15. = *Acreuciroa rostrata* (Thiele & Jaeckel, 1931)

teres, *Neaera* Jeffreys, 1882: 939. North Atlantic. 252-3000 m. **[*Cuspidaria (Rhinoclama)*]**

testai, *Cuspidaria* Knudsen, 1970: 154. Northwest Atlantic. 4380 m. **[*Cuspidaria (Rhinoclama)*]**

thaumasia, *Pseudoneaera* Sturany, 1901: 11. Red Sea, Indian Ocean. 247-1082 m. **[*Pseudoneaera*]**

thomassini, *Protocuspidaria* (*Edentaria*) Poutiers, 1984: 295. West Indian Ocean. 3716 m. **[*Protocuspidaria (Edentaria)*]**

tillamookensis, *Myonera* Dall, 1916a: 23, *nom. nud.*; 1916 b: 407. East and Southwest Pacific, tropical East Atlantic. 436-2850 m. **[*Bathyneaera*]**

toulini, *Cuspidaria* (*Cuspidaria*) Prashad, 1932: 330. West Central Pacific. 275 m. **[*Cuspidaria*]**

toruata, *Pecchiolia* Jeffreys, 1876: 494. North and Central Atlantic. West & Central Indian Ocean. 2085-5300 m. **[*Poromya*]**

torridu, *Verticordia* Hedley, 1906a: 473. Southwest Pacific. 31-37 m. **[*Vertaubitus*]**

Source : MNHN, Paris

tosaensis, *Cuspidaria* (*Cardiomya*) Kuroda, 1948: 18. Northwest Pacific. 28-300 m. **[*Cardiomya*]**
trailli, *Neaera* Hutton, 1873: 62. Southwest Pacific. 9-202 m. **[*Cuspidaria*]**
transversa, *Poromya* Dall, Bartsch & Rehder, 1938: 224. Mid-North Pacific. 474-487 m. **[*Poromya*]**
transversa, *Verticordia* Locard, 1898: 201. Northeast Atlantic, West Indian Ocean. 3700-4165 m. **[*Cetoconcha*]**
trapeza, *Euciroa* Poutiers, 1982: 331. West Pacific. 250-550 m. **[*Euciroa*]**
trapezoidea, *Verticordia* Seguenza, 1876a: 110. = *Haliris granulata* (Seguenza, 1858)
triangularis, *Verticordia* Locard, 1898: 207. Atlantic. 200-3862 m. **[*Vertambitus*]**
trigona, *Neaera* Hinds, 1843: 78. Habitat unknown. **[*?Cuspidaria*]**
trigonalis, *Cuspidaria* Tate, 1897: 45. Southern Australia. 27-64 m. **[*?Pseudoneaera*]**
trigonata, *Thyasira* Yokoyama, 1922: 158. Northwest Pacific. 50-150 m. **[*Simplicicordia*]**
trosaetes, *Cuspidaria* Dall, 1925: 16. Northwest Pacific. 50-650 m. **[*Cuspidaria (Nordoneaera)*]**
trosti, *Poromya* Strong & Hertlein, 1937: 163. Northeast Pacific. 37-398 m. **[*Poromya (Dermatomya)*]**
truncata, *Cuspidaria* Hedley, 1905: 47. Southwest Pacific. 203 m. **[*?Cuspidaria*]**
truncata, *Neaera* Jeffreys, 1880: 316, *nom. nud.*; 1882: 936. North Atlantic. 710-1340 m. **[*Pseudoneaera*]**
tuberata, *Poromya* Jeffreys, 1882: 936. = *Poromya neaeroides* Seguenza, 1876
tuhua, *Cuspidaria* Dell, 1962: 67. South Pacific. 494 m. **[*Cuspidaria*]**
turgida, *Cuspidaria* Verrill & Bush, 1898: 799. Northwest Atlantic. 3338 m. **[*Cuspidaria*]**
typus, *Cuspidaria* Nardo, 1840: 50. = *Cuspidaria cuspidata* (Olivi, 1792)
umbonata, *Poromya* Knudsen, 1982: 129. West Central Atlantic. 850 m. **[*Poromya*]**
undata, *Neaera* Verrill, 1884: 223. Atlantic, Indian Ocean. 4320-5300 m. **[*Cuspidaria*]**
undosa, *Poromya* Hedley & Petterd, 1906: 224. Southwest Pacific. 457-549 m. **[*Poromya*]**
uschakovi, *Lyonsiella* Gorbunov, 1946: 321. Arctic. 1475-2209 m. **[*Policordia (Dallicordia)*]**
vadosa, *Verticordia* Hedley, 1907a: 303. Southwest Pacific. 146 m. **[*Vertambitus*]**
valdiviae, *Cuspidaria* Thiele & Jaeckel, 1931: 225. Indian Ocean. 693-1644 m. **[*Cuspidaria (Rhinoclama)*]**
variola, *Cuspidaria* Bernard, 1979: 16. Northeast Pacific. 2520-2884 m. **[*Cuspidaria*]**
velvetina, *Leionya* (*Plectodon*) *granulata* var. Dall, 1886b: 300. = *Plectodon granulatus* (Dall, 1881)
ventricosa, *Cuspidaria* Verrill & Bush, 1898: 802. Atlantic. 349-3235 m. **[*Cuspidaria*]**
verityi, *Protocuspidaria* (*Protocuspidaria*) Allen & Morgan, 1981: 496. Atlantic. 943-4706 m. **[*Protocuspidaria*]**
verticordia, *Verticordia* Nordsieck, 1969: 170, *non* S.Wood, 1840 (*nom. nud.* = *Verticordia cardiiformis* (Sowerby, 1844), a fossil species of Europe). = *Spinosipella acuticostata* (Philippi, 1844)
vitrea, *Neaera* Lovén, 1846: 202. = *Cuspidaria abbreviata* (Forbes, 1843)
walleri, *Cuspidaria* (*Luzonia*) Bernard, 1989: 64. Northeast Pacific. 100-450 m. **[*Caspidaria (Luzonia)*]**
welluani, *Austroneaera* Fleming, 1948: 82. Southwest Pacific. 7-55 m. **[*Pseudoneaera*]**
willetti, *Cuspidaria* Fleming, 1948: 81. South Pacific. 26-64 m. **[*Cuspidaria*]**
wollastonii, *Neaera* E. A. Smith, 1885: 40. Atlantic. 103-3175 m. **[*Cuspidaria*]**
woodi, *Verticordia* E. A. Smith, 1885: 168. West Atlantic. 180-1850 m. **[*Verticordia*]**

Note 1: Though *Myonera* is considered here as a full genus, distinct from *Cuspidaria*, the name *Cuspidaria* (*Myonera*) *atlantica* Allen & Morgan, 1981, is a primary homonym of *Cuspidaria* (*Cuspidaria*) *atlantica* Allen & Morgan, 1981, and consequently invalid, according to Article 57d of the Code dealing with irrelevance of subgeneric names on homonymy between species-group names. Then, the species has to be renamed, and I am pleased to give it herein the new name of *Myonera alleni*, in honour of my talented friend, Dr John A. Allen of the University Marine Biological Station, Millport.

Source : MNHN, Paris

Note 2: I have examined the type of *Mytilineria compressa* Locard in MNHN. It consists of a single left valve showing lucinoid but not verticordioid affinities: the shell is lenticular, without an external granulation; the interior is not nacreous, the pallial line without a sinus, and the anterior adductor muscle scar elongate, with a ventral expansion parallel to the pallial line.

Note 3: The systematic placement of *Lyonsia formosa* Jeffreys has been much disputed, and is still controversial. First considered a member of family Lyonsiidae, this species has been made a *Lyonsiella* by ALLEN & TURNER (1974) on anatomical grounds. Later, on the basis of ALLEN & TURNER's study, SCARLATO & STAROBOGATOV (1983) created for it the monogeneric family Spinolyonsiellidae and new genus *Spinolyonsiella*. However, as DALL (1903) already made *L. formosa* the type species of *Allogramma*, *Spinolyonsiella* cannot stand and is an objective junior synonym of *Allogramma*.

I refrain from adopting these nomenclatural changes, as it appears that the identity of *L. formosa* (*sensu* Allen & Turner) is problematical. Actually, it is possible that two species (perhaps not closely related) have been mixed, one mainly bathyal, the other abyssal (POUTIERS, 1984). Then, the form DALL had in view when erecting *Allogramma* might be different from that studied by ALLEN & TURNER.

APPENDIX 1

STATION DATA

MUSORSTOM 1 (Philippines)

Stn 5, 19.III.76, North of Lubang Island, 14°01.5′ N, 120°22′ E, 200-215 m; gear: 4 m beam trawl: *Cuspidaria convexa*.

Stn 25, 22.III.76, North of Lubang Island, 14°02.5′ N, 120°22′ E, 191-200 m, sand and mud; gear: 4 m beam trawl: *Cuspidaria prolatissima*.

Stn 26, 22.III.76, North of Lubang Island, 14°00′ N, 120°17′ E, 189 m; gear: 4 m beam trawl: *Poromya butoni*.

Stn 31, 22.III.76, North of Lubang Island, 14°00′ N, 120°17.5′ E, 187-195 m, mud; gear: 4 m beam trawl: *Cuspidaria prolatissima*, *Poromya butoni*.

Stn 34, 23.III.76, North of Lubang Island, 13°59.5′ N, 120° 17.5′ E, 188-191 m; gear: 5 m beam trawl: *Poromya butoni*.

Stn 42, 24.III.76, channel between Lubang and Luzon islands, 13°54.5′ N, 120°29′ E, 379-407 m, hard mud; gear: 5 m beam trawl: *Acreuciroa rostrata*, *Cuspidaria prolatissima*.

Stn 43, 24.III.76, channel between Lubang and Luzon islands, 13°50′ N, 120°28′ E, 448-484 m, mud with plant remains and stones; gear: 5 m beam trawl: *Acreuciroa rostrata*.

Stn 44, 24.III.76, South of channel between Lubang and Luzon islands, 13°46.5′ N, 120°29.5′ E, 592-610 m, mud with plant remains; gear: 5 m beam trawl: *Halicardia philippinensis*, *Euciroa eburnea*.

Stn 47, 25.III.76, Southeast of Lubang Island, 13°41.5′ N, 120°30′ E, 685-757 m, mud with plant remains; gear: 5m beam trawl: *Euciroa eburnea*.

Stn 49, 25.III.76, West of Lubang Island, 13°49′ N, 120°00.5′ E, 750-925 m, mud; gear: 4 m beam trawl: *Spinosipella costellinens*.

Stn 50, 25.III.76, West of Lubang Island, 13°49′ N, 120°02′ E, 415-510 m, mud; gear: 4 m beam trawl: *Halonymphia leionyoides*, *Poromya eximia*.

Stn 58, 26.III.76, North of Lubang Island, 13°58.5′ N, 120°14′ E, 143-178 m, sand and mud; gear: 4 m beam trawl: *Cardiomya gouldiana*.

Source : MNHN, Paris

Stn 61, 27.III.76, North of Lubang Island, 14°01′ N, 120°17.5′ E, 124-129 m, mud; gear: 4 m beam trawl: *Poromya butoni.*
Stn 63, 27.III.76, North of Lubang Island, 14°00.5′ N, 120°16′ E, 191-195 m, mud; gear: 4 m beam trawl: *Cuspidaria lubangensis, Cuspidaria steindachneri.*
Stn 71, 28.III.76, Northeast of Lubang Island, 14°09.5′ N, 120°26.5′ E, 174-204 m, sand and mud; gear: 4 m beam trawl: *Cuspidaria gigantea, Cuspidaria hindsiana.*
Stn 72, 28.III.76, Southwest of Corregidor Island, 14°12.5′ N, 120°29′ E, 122-127 m, hard mud; gear: 4 m beam trawl: *Poromya butoni.*
Stn 73, 28.III.76, Southwest of Corregidor Island, 14°16′ N, 120°31.5′ E, 70-76 m, sand and mud; gear: 4 m beam trawl: *Poromya butoni.*

MUSORSTOM 2 (Philippines)

Stn 2, 20.XI.80, North of Lubang Island, 14°00.5′ N, 120°17.3′ E, 184-186 m; gear: 4 m beam trawl: *Enciroa crassa.*
Stn 6, 20.XI.80, North of Lubang Island, 13°56.5′ N, 120°21.5′ E, 136-152 m; gear: 4 m beam trawl: *Euciroa crassa.*
Stn 10, 21.XI.80, North of Lubang Island, 14°00.7′ N, 120°18.2′ E, 188-195 m; gear: 4 m beam trawl: *Cuspidaria gigantea, Euciroa crassa.*
Stn 11, 21.XI.80, North of Lubang Island, 14°00.3′ N, 120°19.3′ E, 194-196 m; gear: 4 m beam trawl: *Cuspidaria japonica.*
Stn 15, 21.XI.80, channel between Lubang and Luzon islands, 13°55′ N, 120°28.9′ E, 326-330 m; gear: 4 m beam trawl: *Acreuciroa rostrata.*
Stn 17, 22.XI.80, North of Lubang Island, 14°00.5′ N, 120°17.8′ E, 174-193 m; gear: 4 m beam trawl: *Euciroacrassa, Cuspidaria prolatissima.*
Stn 19, 22.XI.80, North of Lubang Island, 14°00.6′ N, 120°17.4′ E, 189-192 m; gear: 4 m beam trawl: *Euciroamillegemmata, Cuspidaria nobilis, Poromya butoni.*
Stn 21, 22.XI.80, North of Lubang Island, 14°01.2′ N, 120°17.6′ E, 191-192 m; gear: 4 m beam trawl: *Cuspidaria nobilis, Cuspidaria prolatissima.*
Stn 25, 23.XI.80, Verde Island Passage, 13°39.5′ N, 120°42.9′ E, 520-550 m; gear: 4 m beam trawl: *Cuspidaria kyushuensis, Cardiomya alcocki, Poromya eximia.*
Stn 26, 23.XI.80, Verde Island Passage, 13°49′ N, 120°50.3′ E, 299-320 m; gear: 4 m beam trawl: *Euciroa crassa, Cuspidaria corrugata, Cuspidaria gigantea, Cuspidaria prolatissima, Poromya butoni.*
Stn 32, 24.XI.80, Verde Island Passage, 13°40.5′ N, 120°54′ E, 192-220 m; gear: geological dredge: *Enciroa millegemmata.*
Stn 33, 24.XI.80, Verde Island Passage, 13°32′ N, 121°07.5′ E, 130-137 m; gear: 1.20 × 0.50 m rectangular dredge: *Spinosipella deshayesiana, Haliris multicostata.*
Stn 39, 25.XI.80, South of Mompog Passage, 13°08′ N, 122°36.3′ E, 1030-1190 m; gear: 4m beam trawl: *Cuspidaria macrorhynchus, Poromya eximia.*
Stn 40, 25.XI.80, South of Mompog Passage, 13°08′ N, 122°40.2′ E, 280-440 m; gear: 4 m beam trawl: *Myonera rostra.*
Stn 44, 26.XI.80, Mompog Passage, 13°23.5′ N, 122°20.6′ E, 760-820 m; gear: 4 m beam trawl: *Cuspidaria macrorhynchus, Poromya eximia.*
Stn 46, 26.XI.80, Mompog Passage, 13°26.2′ N, 122°17.3′ E, 445-520 m; gear: 4 m beam trawl: *Poromya eximia.*
Stn 49, 26.XI.80, Northwest of Marinduque Island, 13°38.8′ N, 121°43.2′ E, 416-425 m; gear: 4 m beam trawl: *Cuspidaria convexa.*
Stn 50, 27.XI.80, East of Golo Island, 13°37.4′ N, 120°33′ E, 810-820 m; gear: 4 m beam trawl: *Euciroa eburnea.*

Source : MNHN, Paris

Stn 51, 27.XI.80, North of Lubang Island, 13°59.8′ N, 120°17′ E, 170-187 m; gear: 4 m beam trawl: *Spinosipella deshayesiana, Euciroa crassa, Cuspidaria gigantea, Cuspidaria nobilis, Cuspidaria prolatissima.*

Stn 55, 27.XI.80, West of Cabra Island, 13°53.4′ N, 119°57.8′ E, 865-866 m; gear: 4 m beam trawl: *Spinosipella costeniitens.*

Stn 56, 28.XI.80, West of Cabra Island, 13°54.1′ N, 119°56.7′ E, 970 m; gear: 4 m beam trawl: *Cetoconcha exigua.*

Stn 59, 28.XI.80, North of Lubang Island, 14°00.4′ N, 120°17′ E, 186-190 m; gear: 4 m beam trawl: *Cuspidaria nobilis, Poromya butoni.*

Stn 63, 29.XI.80, North of Lubang Island, 14°07.3′ N, 120°15.5′ E, 215-230 m; gear: 4 m beam trawl: *Cuspidaria prolatissima.*

Stn 64, 29.XI.80, North of Lubang Island, 14°00.8′ N, 120°18.6′ E, 191-195 m; gear: 4 m beam trawl: *Euciroa crassa, Cuspidaria prolatissima.*

Stn 68, 29.XI.80, North of Lubang Island, 14°01.2′ N, 120°18.2′ E, 195-199 m; gear: 4 m beam trawl: *Euciroa crassa, Cuspidaria japonica, Cuspidaria nobilis, Cuspidaria prolatissima.*

Stn 71, 30.XI.80, North of Lubang Island, 14°00.6′ N, 120°18.5′ E, 189-197 m; gear: 4 m beam trawl: *Euciroa crassa, Cuspidaria nobilis.*

Stn 72, 30.XI.80, North of Lubang Island, 14°00.4′ N, 120°18.6′ E, 182-197 m; gear: 4 m beam trawl: *Euciroa crassa, Cuspidaria corrugata, Poromya butoni.*

Stn 75, 01.XII.80, channel between Lubang and Luzon islands, 13°51.9′ N, 120°30.1′ E, 300-330 m; gear: 4 m beam trawl: *Acreuciroa rostrata, Cetoconcha boucheti, Poromya eximia.*

Stn 78, 01.XII.80, channel between Lubang and Luzon islands, 13°49.5′ N, 120°28.5′ E, 441-550 m; gear: 4 m beam trawl: *Acreuciroa rostrata, Poromya eximia.*

Stn 79, 01.XII.80, channel between Lubang and Luzon islands, 13°44′ N, 120°31.7′ E, 682-770 m; gear: 4 m beam trawl; material: *Euciroa eburnea.*

Stn 80, 01.XII.80, South of Cape Santiago, Luzon Island, 13°45.2′ N, 120°37.5′ E, 178-205 m; gear: 4 m beam trawl: *Cuspidaria corrugata, Cuspidaria nobilis, Cuspidaria prolatissima.*

Stn 81, 01.XII.80, Verde Island Passage, 13°35.3′ N, 121°01.3′ E, 856-884 m; gear: 4 m beam trawl: *Myonera dautzenbergi.*

Stn 82, 02.XII.80, channel between Lubang and Luzon islands, 13°47′ N, 120°28.8′ E, 550 m; gear: 4 m beam trawl: *Euciroa eburnea, Acreuciroa rostrata, Poromya eximia.*

Stn 83, 02.XII.80, channel between Lubang and Luzon islands, 13°55.9′ N, 120°30.5′ E, 318-320 m; gear: 4 m beam trawl: *Acreuciroa rostrata, Cuspidaria prolatissima.*

CORINDON 2 (Makassar Strait, Indonesia)

Stn 208, 31.X.80, East of Borneo, 0°14.6′ S, 117°52′ E, 150 m; gear: 4 m beam trawl: *Cetocoucha gloriosa.*

Stn 231, 04.XI.80, Northwest of Sulawesi, 0°04.9′ N, 119°47.8′ E, 980-1080 m; gear: 4 m beam trawl: *Policordia olivacea.*

Stn 267, 07.XI.80, West of Sulawesi, 1°56.6′ S, 119°16.7′ E, 134-186 m; gear: 4 m beam trawl: *Cuspidaria nobilis.*

Stn 280, 08.XI.80, West of Sulawesi, 1°59′ S, 119°09.9′ E, 715-800 m; gear: 4 m beam trawl: *Myonera dautzenbergi.*

Stn 281, 08.XI.80, West of Sulawesi, 1°59′ S, 119°09.9′ E, 715-800 m; gear: 4 m beam trawl: *Cardiomya alcocki.*

Source : MNHN, Paris

"Albatross" (Northeastern Borneo)

Stn 5582, 26.IX.09, Si Amil Island, off Darvel Bay, 4°19.9′ N, 118°58.6′ E, 1628 m, gray mud and fine sand; gear: 12-foot beam trawl: *Halicardia houbricki.*

"Vauban" 1978-1979 (Southern New Caledonia)

Stn 2, 23.V.78, 22°17′ S, 167°14′ E, 425-430 m: *Spinosipella deshayesiana, Haliris multicostata.*
Stn 3, 23.V.78, 22°17′ S, 167°12′ E, 390 m: *Haliris teporis.*
Stn 4, 23.V.78, 22°17′ S, 167°13′ E, 400 m: *Spinosipella deshayesiana.*
Stn 9, 24.V.78, 22°20′ S, 167°10′ E, 175-200 m: *Cetoconcha japonica.*
Stn 14, 28.V.78, 22°16′ S, 167°17′ E, 465-495 m: *Euciroa trapeza.*
Stn 15, 10.IV.78, 22°49′ S, 167°12′ E, 390-395 m: *Spinosipella deshayesiana, Euciroa eburnea.*
Stn 16, 19.IV.78, 22°46′ S, 167°12′ E, 390-400 m: *Spinosipella deshayesiana.*
Stn 33, 06.VI.79, 22°33′ S, 166°25′ E, 290-350 m: *Euciroa trapeza.*
Stn 34, 06.VI.79, 22°32′ S, 166°26′ E, 350-420 m: *Euciroa trapeza.*
Stn 39, 07.VI.79, 22°29′ S, 166°23′ E, 375-550 m: *Euciroa trapeza.*
Stn 40, 07.VI.79, 22°30′ S, 166°24′ E, 250-350 m: *Haliris multicostata, Euciroa trapeza.*
Stn 42, 26.IX.79, 22°08′ S, 167°04′ E, 230-260 m: *Spinosipella deshayesiana, Cuspidaria clathrata, Cuspidaria morrisae, Myonera caduca.*

APPENDIX 2

System of the bivalve molluscs of the superorder Septibranchia. *O. A. Scarlato & Ya. I. Starobogatov (1983)*

[*Translation by J.-M. Poutiers & J. P. Rocroi*]

Septibranch bivalve molluscs are distinguished by an extreme uniformity of their conchological characters. Each of the 3 Recent orders of this superorder (SCARLATO & STAROBOGATOV, 1979) is characterized on the whole by 1-2 types of shells. Hinges generally differ the one from the other only in their degree of reduction (*i.e.* by a negative feature); moreover, even the most complete hinge is so reduced that it is difficult to conclude whether it results from an heterodont or a preheterodont hinge (the second proposal seems to us the most likely). Ligaments are also completely uniform — that is, either marginal and visible from the outside (in Fordillidae and in Recent poromyoid forms), or with a developed resilium and provided with a lithodesma (in verticordioid and cuspidarioid forms). Simultaneously, the accumulation of anatomical data (among the most recent ones: KNUDSEN 1970; ALLEN & TURNER, 1974; BERNARD, 1974; IVANOVA, 1977; ALLEN & MORGAN, 1981; MORTON, 1982) instances the rather important taxonomic diversity of the superorder's components. One is entitled to conclude that the arguments of conchological order generally used for the generic classification of bivalves are inapplicable to septibranchs, and that one is confronted with a basic problem, the elaboration of new criteria suitable for the superorder in question.

To classify families and high level taxa, we propose to use anatomical characters, and first of all the branchial apparatus-septum structure — the organ that best characterizes the representatives of the superorder. It appears especially appropriate since study of the septibranchs anatomy is by far much more complete than the one of other bivalve molluscs.

Nowadays, it is very well established (ALLEN & MORGAN, 1981) that septum developed mainly at the expense of the inner demibranchs and by reduction of the reflexion of their filaments. The

Source : MNHN, Paris

following can be added to that is exposed in the above mentioned work. The hypothesis of ALLEN & MORGAN, attributing the origin of posterodorsal septal muscles in muscular fibres of the outer demibranch's filaments, perfectly suit for the poromyoid forms, especially since it is easy to relate the posterior group of the septal openings of Cetoconchidae to the interfilamental grooves of the outer demibranch. On the contrary, posterior septal musculature of the cuspidarioid forms seems to have another origin. Judging on their disposition, posterolateral muscles (but in primitive cuspidarioids, only them and those situated in posterior part of septum) derive from musculature of the intersiphonal wall. Then, to increase efficiency of the septum's function, posterodorsal muscles originate, probably completely at the expense of the gathering of posterior fibres of the lateral muscles; posterodorsal muscles are no more necessary, and this leads to their gradual reduction (ALLEN & MORGAN, 1981). The lateral septal muscles, initially diffuse, even after separation of the posterodorsal muscles, and adhering generally along a line, concentrate into 2 pairs of fibres. A series of basic differences can be noticed about the septal openings disposition (reticulate windows, groups of openings, variable number of the series of openings).

By means of basic features of the branchial apparatus, verticordioid forms can be grouped in two suborders, according to the degree of development of the outer demibranchs and to the stomach's structure (IVANOVA, 1977). A small group, representatives of which have a complete septum, can be even related to cuspidarioid forms, and placed in a particular suborder. In the group of cuspidarioid forms, differences in the septum structure allow to split these forms into several families which are grouped together in two superfamilies; a third superfamily comprises the Eocene cuspidarioids with a developed nacreous layer (for that, they are often placed among poromyoids, despite their shell shape). For similar reasons, poromyoid forms must also be grouped in 2 superfamilies and 4 families.

We are not concerned with systematics of genera, since it needs a thorough study. However, grouping of the main known genera in families compels us to establish series of genera, when representatives of a traditional conchological genus fall in different families. The extinct order of conocardioids has been already considered (STAROBOGATOV, 1977). It is more varied when shell structure is taken into account, and since a conchological classification is easy to do. About the septum structure of its representatives, one may notice that two types of distribution can be observed there for the lateral muscles, and that the same exists in cuspidarioids: along a line or in a few bundles.

In the above exposed system, to designate the geological age of each genus, we use the latin abbreviation of the epoch (with R for Recent). Besides, to avoid coincidence between denominations of orders and suborders and those of genera, we use standardized suffixes, which are not of common usage in malacology, but are accepted in the systematics of other groups of animals: -oidei for suborders, -iformes for orders, -iformii for superorders; and we recommend that, in future, their use becomes widespread in malacology, because they are more convenient.

Superorder Septibranchia Pelseneer, 1889 (= Conocardiiformii Neumayr, 1891).
Order Verticordiiformes Scarlato & Starobogatov, 1971.
Suborder Fordilloidei Pojeta, 1975.
Gills composed of two demibranchs; a dorsal projection in stomach.
Superfamily Fordilloidea. Fordillidae Pojeta, 1975: *Fordilla* Barrande, 1881 — Cm, *Neofordilla* Krasilova, 1977 — O.
Superfamily Parilimyoidea. Parilimyidae Morton, 1981: *Procardia* Meek, 1871 — J-Cr, *Bucardiomya* Rollier *in* Cossmann, 1912 — J-Pg, (?) *Triplicosta* Cooper, 1897 — Pg, *Parilimya* Melvill & Standen, 1899 — R, *Panacca* Dall, 1905 — R, *Nipponipanacca* Habe, 1977 — R.
Superfamily Euciroidea. Euciroidae Dall, 1894: *Euciroa* Dall, 1881 — R, *Acreuciroa* Thiele & Jaeckel, 1931 — R, *Kurinuia* Marwick, 1942 — Pg; Lyonsiellidae Scarlato & Starobogatov, 1971: *Lyonsiella* G. Sars, 1872 — R, *Proagorina* Iredale, 1930 — R, *Rectilyonsiella* gen. nov. (type

Source : MNHN, Paris

species *Lyonsiella coupressa* Allen & Turner, 1974. Shell rectangular, elongate, compressed; sculpture of raised and distinct small radial lines; hinge without teeth) — R; Policordiidae Scarlato, 1980: *Halicardia* Dall, 1895 — R, *Halicardissa* Dall, 1913 — R, *Vertisphaera* Iredale, 1930 — R, *Policordia* Dall, Bartsch & Rehder, 1939 — R (in this genus we provisionally include genus *Latebranchia* Ivanova gen. nov.; for its diagnosis, see: IVANOVA, 1977: 189, type species *Policardia obliquaeovata* Ivanova, 1977 here designated by IVANOVA).

Suborder Verticordioidei Scarlato & Starobogatov, 1971.

Gills are only composed of the inner demibranchs and sometimes by remnants of posterior part of the outer demibranchs; no dorsal projection in stomach.

Spinolyonsiellidae fam. nov. Shell rectangular, as in lyonsiellids, with prosogyrous and sharply prominent umbones. Surface with small spines arranged in radial rows; radial sculpture absent or formed by a keeled flexure posteriorly and a few nearby ribs; hinge without teeth: *Spinolyonsiella* gen. nov. (type species *Lyonsia formosa* Jeffreys, 1881. Shell with slightly anterior umbones; dorsal margin feebly curved; radial ribs well marked) — R, *Allenicordia* gen. nov. (type species *Pecchiolia subquadrata* Jeffreys, 1881. Shell with strongly prosogyrous and decidedly anterior umbones; dorsal margin strongly curved, especialy in front of umbones; radial ribs absent) — R; Verticordiidae Stoliczka, 1871: *Verticordia* Sowerby, 1844 (with subgenus *Spinosipella* Iredale, 1930) — Pg-R, *Vertambitus* Iredale, 1930 — R, *Haliris* Dall, 1886 (with subgenus *Setaliris* Iredale, 1930) — R, *Pecchiolia* Savi & Meneghini *in* Murchison, 1850 — Pg-Ng, *Trigonulina* d'Orbigny, 1846 — R, *Simplicicordia* Kuroda & Habe, 1971 — R, *Laevicordia* Seguenza, 1876 — Ng-R, *Angustebranchia* Ivanova gen. nov. (for its diagnosis, see: IVANOVA, 1977: 177-180, type species *Policardia rectangulata* Ivanova, 1977, here designated by IVANOVA) — R.

Order Conocardiiformes Neumayr, 1891.

Suborder Eopterioidei subordo nov.

Valves open under the action of a ligament and are closed by 1 or 2 adductors; septal muscles attached to valves by 3 pairs of bundles.

Superfamily Eopterioidea. Two adductors. Eopteriidae Miller, 1889: *Eopteria* Billings, 1865 — O; Stolidotidae Starobogatov, 1977: (?) *Myona* Kobayashi, 1935 — Cm, *Eoischyrina* Kobayashi, 1933 — O, *Maniuka* Barrande, 1881 — O-S, *Stolidotus* Hede, 1915 — S.

Superfamily Pseudotechnophoroidea. One adductor. Pseudotechnophoridae Starobogatov, 1977: *Pseudotechnophorus* Kobayashi, 1933 — O.

Suborder Conocardioidei Neumayr, 1891.

Valves heavy; in living animal, they remain closed and are only pulled apart as growth goes on; adductors reduced; septal muscles not gathering in bundles and attached along a line.

Superfamily Euchasmatoidea. Wanwaniidae fam. nov. Keel flexure feeble. *Wanwania* Kobayashi, 1933 — O, *Apoptopegma* Pojeta, G.-T., Sherg., 1977 — O, Euchasmatidae Starobogatov, 1977: *Euchasma* Billings, 1865 — O, *Euchasmella* Kobayashi, 1933 — O, *Pseudeuchasma* Kobayashi, 1933 — O, *Tenka* Barrande, 1881 — O-S, *Tetinka* Barrande, 1881 — S-D, *Conocardiopsis* Beushausen, 1895 — D.

Superfamily Conocardioidea. Bransoniidae Pojeta & Runnegar, 1976: *Bransonia* Pojeta & Runnegar, 1976 — O-P, *Mulseodens* Pojeta & Runnegar, 1976 — S-D, *Pseudoconocardium* Zavodowsky, 1960 — C-T; Hippocardiidae Pojeta & Runnegar, 1976: *Hippocardia* Brown, 1843 — O-C, *Rhipidocardium* Fischer, 1887 — S, *Bigalea* Pojeta & Runnegar, 1976 — S-D; Conocardiidae Miller, 1889: *Conocardium* Brown, 1835 — D-C, *Arceodonus* Pojeta & Runnegar, 1976 — C-P.

Source : MNHN, Paris

Suborder Ribeirioidei Kobayashi, 1933.

Superfamily Ribeirioidea. Shell oval or elongate, with a rounded anterior margin, without keel or radial sculpture. Ozomiidae Starobogatov, 1977: *Ozomia* Walcott, 1934 — O; Ribeiriidae Kobayashi, 1933: *Ribeiria* Sharpe, 1853 — Cm-O, *Pinnocaris* Etheridge, 1878 — Cm-O, *Ribeirina* Billings, 1865 — O.

Superfamily Technophoroidea. Shell quadrate, elongate, with a sharp keel and often a radial sculpture on carinal area. Technophoridae Miller, 1889: *Kimopegma* Pojeta, Gilbert-Tomlinson & Shergold, 1977 — Cm, *Pleuropegma* Pojeta, Gilbert-Tomlinson & Shergold, 1977 — Cm, *Opikella* Runnegar & Pojeta, 1974 — Cm, *Anisotechnophorus* Pojeta & Runnegar, 1976 — O, *Technophorus* Miller, 1889 — O, *Myocaris* Salter, 1864 — O.

Superfamily Ischyrinioidea. Tomalchoviidae Starobogatov, 1977: *Cymatopegma* Pojeta, Gilbert-Tomlinson & Shergold, 1977 — Cm, *Tolmachovia* Howell & Kobayashi, 1936 — O, *Ptychopegma* Pojeta, Gilbert-Tomlinson & Shergold, 1977 — O, *Pauropegma* Pojeta, Gilbert-Tomlinson & Shergold, 1977 — O; Ischyriniidae Kobayashi, 1933: *Ischirinia* Billings, 1866 — O.

Order Poromyiformes Pelseneer, 1906.

Superfamily Dermatomyoidea. Septum with pairs of reticulated areas. Dermatomyidae fam. nov. Two pairs of reticulated areas: *Dermatomya* Dall, 1889 — R, *Ectorisma* Tate, 1892 — We include here most species of genus *Poromya*, but those grouped with *P. granulata* (Nyst & Vestendorp) — R, *Cetomya* Dall, 1889 — R, *Liopistha* Meek, 1864 — Cr, *Psilomya* White, 1874 — Cr, *Cymella* Meek, 1864 — Cr; Perlaporomyidae fam. nov. One (medial) pair of reticulated areas: *Perlaporomya* gen. nov. (type species *Poromya perla* Dall, 1908. Shell quadrate, quite as long as high; very small tubercles covering the outer surface; posterior part demarcated by a feeble groove; one subumbonal tooth on right valve, with a corresponding socket on left valve; reticulated areas with 18 to 20 filaments) — R.

Superfamily Poromyoidea. Septum with groups of paired pores. Cetoconchidae Ridewood, 1903: *Cetoconcha* Dall, 1886 — R; Poromyidae Dall, 1886: *Poromya* Forbes, 1884 — R, *Mioporomya* Sacco, 1901 — Ng.

Order Cuspidariiformes Scarlato & Starobogatov, 1971.

Suborder Dallicordioidei subordo nov. Shell verticordioid; a very large incoming siphonal opening, with many tentacles around; septum with 2 groups of openings on each side (in front of and behind the foot); septal musculature developed towards left; bundles obvious, corresponding with the existing filaments of inner demibranch.

Dallicordiidae fam. nov. Shell interiorly nacreous, septum with 4 pairs of openings: 2 pairs near the oral funnel and 2 pairs behind the foot; posterior part of oral lobes largely united with septum, *Dallicordia* gen. nov. (type species *Lyonsiella alaskana* Dall, 1895. Shell rounded, irregularly pentagonal, truncated on anterior margin and rounded towards posterior margin; sculpture composed of narrow radial threads; hinge without teeth. *L. ushakovi* Gorbunov and *Policordia ochotica* Scarlato can also be placed in this genus) — R.

Suborder Cuspidarioidei Scarlato & Starobogatov, 1971.

Shell cuspidariid, with reduced siphonal openings, thus located both inside the rostrum at siphon's extremity; septum with only one group of openings (4 to 20) on each side, strongly muscularized; besides are developed, firstly 2 anterior pairs of muscles, and also posterior (1 or 2 pairs) and lateral (in a line or in 2 pairs) muscles.

Superfamily Neaeroporomyoidea. Neaeroporomyidae fam. nov. Shell interiorly nacreous, its posterior part somewhat drawn out into a rostrum; hinge with a subumbonal tooth on each valve: *Neaeroporomya* Cossmann, 1887 — Pg, *Pseudocuspidaria* Eames, 1951 — Pg.

Superfamily Protocuspidarioidea. Protocuspidariidae fam. nov. Shell not nacreous, rostrum short so that the anterior part of dorsal shell margin is straight and horizontal; hinge without teeth or

Source : MNHN, Paris

with an anterior tooth on only one valve or on both valves; septum comprising more than 10 pairs of short filaments among which septal openings are distributed: *Bidentaria* Allen & Morgan, 1981 — R, *Protocuspidaria* Allen & Morgan, 1981 — R, *Edentaria* Allen & Morgan, 1981 — R.

Superfamily Cuspidarioidea. Halonymphidae fam. nov. 8-20 pairs of septal openings; among the posterior septal muscles, posterolateral ones are only present; lateral septal muscles attached along a line: *Halonympha* Dall & Smith, 1886 — R, *Allenineaera* gen. nov. (type species *Neaera circinnata* Jeffreys, 1881. Shell oval quadrate, with a well-marked, straight, short rostrum and with a straight dorsal margin; sculpture composed of fine concentric ribs) — R, *Octoporia* gen. nov. (type species *Myonera octoporosa* Allen & Morgan, 1981. Shell drawn out in its posterior part in a long, rounded at the end, rostrum; dorsal and ventral margins of rostrum slightly concave; sculpture composed of concentric ridges, more strongly impressed on anterior part; hinge without teeth) — R; Cardiomyidae fam. nov. 4-5 pairs of septal openings; posterodorsal and posterolateral muscles simultaneously present; lateral septal muscles attached along a line: *Cardiomya* A. Adams, 1864 — Cr-R, *Kurodamya* Okutani & Sakurai, 1964 — R, *Semicardiomya* gen. nov. (type species *Myonera demistriata* Allen & Morgan, 1981. Shell with radial ribs on posterior half or on central and posterior parts, but with concentric ribs on anterior part; hinge without teeth) — R, *Bathyneaera* gen. nov. (type species *Cuspidaria hadalis* Knudsen, 1970. Shell compressed, with a feebly demarcated, rather short rostrum; strong radial ribs on posterior half of valves; hinge without teeth) — R; Myoneridae fam. nov. 4-5 pairs of septal openings; posterodorsal muscles only present; lateral septal muscles attached along a line: *Jeffreysiomya* Nordsieck, 1969 — Cr-R, *Vulcanomya* Dall, 1886 — R, *Leiomya* A. Adams, 1864 — R, *Pseudoneaera* Sturany, 1902 — R, *Rhinoclama* Dall & Smith, 1886 — R, *Luzonia* Dall & Smith, 1886 — R, *Tergulina* Doncieux, 1911 — Pg, *Bowdenia* Dall, 1963 — Ng, *Rengea* Kuroda & Habe, 1971 — R, *Myonera* Dall & Smith, 1886 — R, *Plectodon* Carpenter, 1864 — Ng-R; Cuspidariidae Dall, 1886. 4-5 pairs of septal openings; posterodorsal muscles only present; lateral septal muscles united in 2 pairs of fibres, attached at extremity to valves: *Cuspidaria* Nardo, 1840 — R — Here, we only place *C. cuspidata* (Olivi), *C. jeffreysi* (Dall), *C. ventricosa* Verrill & Bush, *C. parkeri* Knudsen, *C. barnardi* Knudsen —, *Austroneaera* Powell, 1937 — R — Here, because of the shell form, we include also *Rhinoclama abrupta* Allen & Morgan, 1981 and we determine the systematic placement of genus because of the anatomical features of this species.

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YONGE, C. M., 1947. — The pallial organs in the aspidobranch Gastropoda and their evolution throughout the Mollusca. *Philosophical Transactions of the Royal Society of London*, (B) **232**: 443-517.

NOTE ADDED IN PRESS:

The present paper was in press when the following paper by Krylova was published, containing the description of one new genus, one new subgenus, and nine new species.

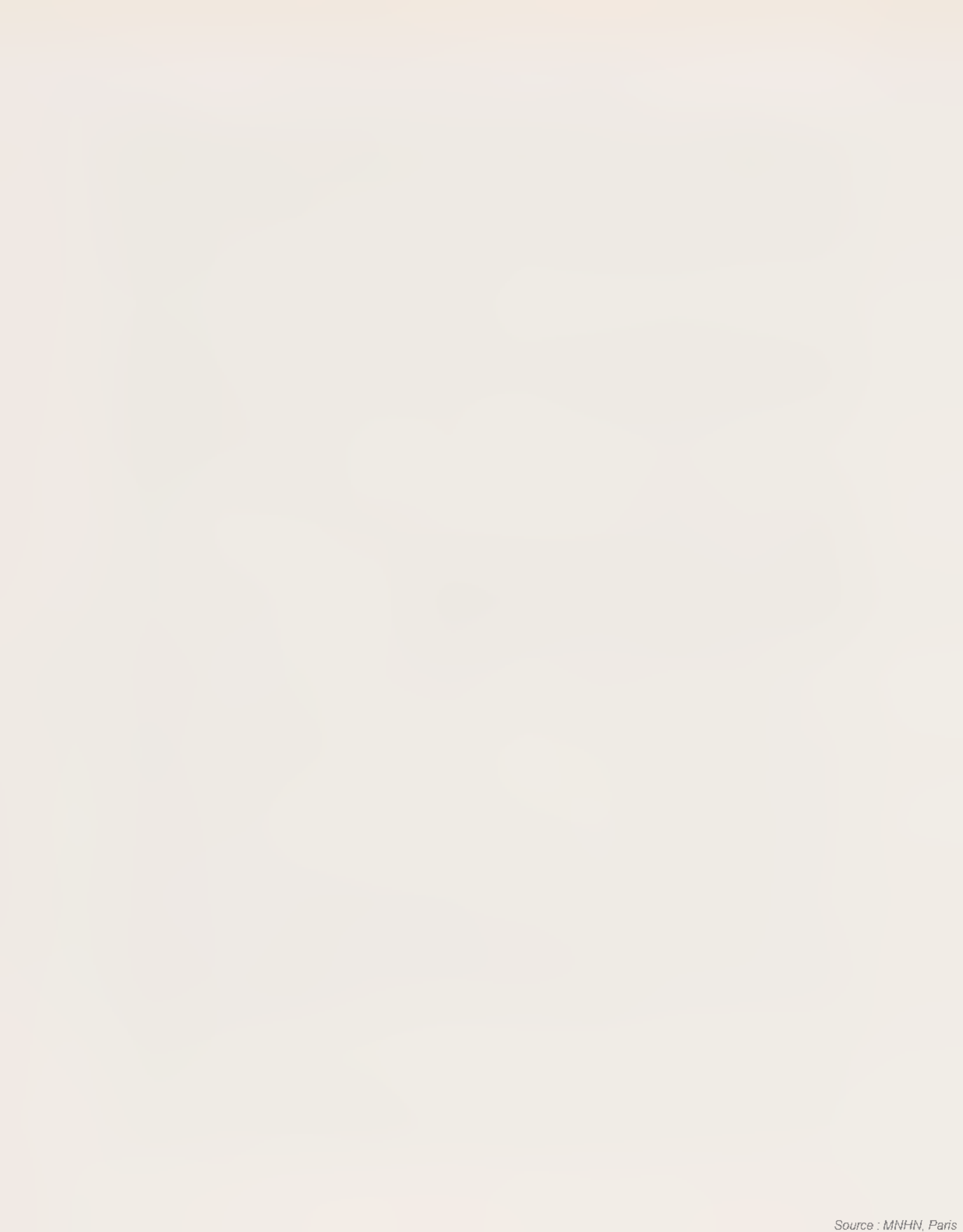
KRYLOVA, E. M., 1995. — [Bivalve molluscs of the family Protocuspidariidae (Septibranchia, Cuspidarioidea): composition and distribution.] *Zoologicheskyi Zhurnal*, **74** (9): 20-38. [in Russian]

New taxa:

Dentaria Krylova, 1995. Type species (OD): *Multitentacula (Dentaria) parvula* Krylova, 1995.
Multitentacula Krylova, 1995. Type species (OD): *Multitentacula admirabilis* Krylova, 1995.

amoena, *Multitentacula (Dentaria)* Krylova, 1995. Kuriles-Kamchatka Trench, 5060 m.
composita, *Multitentacula (M.)* Krylova, 1995. Caribbean, 2970-3080 m.
fragilis, *Protocuspidaria (P.)* Krylova, 1995. Norhteast Atlantic, 3714 m.
parilis, *Multitentacula (Dentaria)* Krylova, 1995. Peru Trench, 2330 m.
parvula, *Multitentacula (Dentaria)* Krylova, 1995. Western Atlantic, 4205 m.
paulula, *Multitentacula (Dentaria)* Krylova, 1995. Southeast Atlantic, 4725 m.
pusilla, *Protocuspidaria (Edentaria)* Krylova, 1995. Northeast Pacific, 5840 m.
speciosa, *Protocuspidaria (Edentaria)* Krylova, 1995. Eastern Atlantic, 4278 m.
venusta, *Multitentacula (M.)* Krylova, 1995. Great Australian Bight, 3880 m.

Source : MNHN, Paris



Source : MNHN, Paris

4

Scaphopoda of the tropical Pacific and Indian Oceans, with description of 3 new genera and 42 new species

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ABSTRACT

New data on the scaphopod fauna of the Indo-West Pacific are presented, based on new material from recent oceanographic expeditions, mostly in the SW Indian Ocean, SE Asia and the New Caledonia region. Over 780 stations yielded a total of 139 species. Of 81 species of Dentaliida and 58 Gadilida, 42 species (16 Dentaliida and 26 Gadilida), as well as 3 gadilid genera, are described as new. Many range extensions are documented, and new synonymies are established. With 73 recorded species, New Caledonia is currently the geographic area with the highest documented scaphopod diversity. Their bathymetric distribution shows a peak in species numbers in deep water around 800 m, with a second, minor peak for Gadilida at around 2,000 m. Including genera not represented in the Indo-Pacific, 44 Recent scaphopod genera are recognized. The radula of 42 of these is described, and an update of the general classification of the class Scaphopoda is proposed.

RÉSUMÉ

Scaphopodes des régions tropicales de l'océan Indien et du Pacifique, avec la description de 3 nouveaux genres et 42 espèces nouvelles.

La faune de Scaphopodes de l'Indo-Pacifique est étudiée sur la base du matériel récolté par diverses campagnes océanographiques récentes, en particulier dans le Sud-Ouest de l'océan Indien, l'Asie du Sud-Est et la région néo-calédonienne. Au total, plus de 780 stations ont livré 139 espèces. Sur 81 espèces de Dentaliida et 58 Gadilida, 42 espèces (16 Dentaliida et 26 Gadilida), de même que 3 genres de Gadilida, sont décrits comme nouveaux. L'aire de distribution connue de nombreuses espèces se trouve étendue, et de nouvelles synonymies sont établies. Soixante-treize espèces sont recensées en Nouvelle-Calédonie, ce qui en fait le secteur de l'Indo-Pacifique avec la faune de Scaphopodes la plus diversifiée. La distribution bathymétrique de cette faune montre un maximum de diversité autour de 800 m, et un deuxième maximum, plus atténué, pour les Gadilida autour de 2000 m. En comprenant les genres non représentés dans l'Indo-Pacifique, 44 genres actuels de Scaphopodes sont reconnus. La radula de 42 d'entre eux est décrite, et la classification de la classe est mise à jour.

SCARABINO, V., 1995. — Scaphopoda of the tropical Pacific and Indian Oceans, with description of 3 new genera and 42 new species. *In*: P. BOUCHET (ed.), Résultats des Campagnes MUSORSTOM, Volume 14. *Mém. Mus. natn. Hist. nat.*, **167**: 189-379. Paris ISBN 2-85653-217-9.

Published 29th December 1995.

Source : MNHN, Paris

INTRODUCTION

The present paper is based essentially on the collections made over the last 20 years in the Indo-Pacific by MNHN staff and other French scientists, notably from ORSTOM. It covers parts of the Western Pacific, with emphasis on the Philippines, Indonesia and New Caledonia, and parts of the Indian Ocean, with emphasis on its southwestern portion around Madagascar and the Mascarenes. Much of the material was collected aboard R.V. *"Vauban"*, *"Coriolis"* , and *"Alis"* during the six MUSORSTOM expeditions to the Philippines (1976-1985; for narratives and station lists, see FOREST, 1981, 1986) and New Caledonia (1985-1989; for narratives of these, and other, cruises in the New Caledonia area, together with station lists, see RICHER DE FORGES, 1990 and 1991). There is also a substantial amount of material from a dozen other expeditions on French research vessels, among others Cruise 32 of R.V. *"Marion-Dufresne"* (Réunion island; see GUILLE, 1982), CORINDON (R.V. *"Coriolis"*, Makassar Channel, 1980) and BENTHEDI (R.V. *"Suroit"*, Mozambique Channel, 1977).

Beside the material in MNHN, I have also studied the Scaphopoda taken during the *"Snellius"* I (1929-1930; see BOSCHMA, 1936) and *"Snellius"* II Expeditions (1984; see ANONYMOUS) in Indonesia (RMNH), the *"Galathea"* Expedition (1950-52; see BRUUN, 1959) (ZMC) and the *"Meiring Naudé"* cruises (1976 and 1979; see LOUW, 1977, 1980) off South Africa (SAM). Whenever possible and necessary, I have examined relevant type material and other reference material, as listed under each species.

There has been no recent review of the scaphopod fauna of the Indo-Pacific. Many species descriptions are scattered in the reports of major expeditions such as those of the *"Challenger"* (WATSON, 1879), *"Investigator"* (SMITH, 1894 to 1906), *"Siboga"* (BOISSEVAIN, 1906), *"Valdivia"* (PLATE, 1908a, JAECKEL, 1932), and *"John Murray"* (LUDBROOK, 1954). Part of the extensive Japanese literature concerns directly the tropical Indo-Pacific, and CHISTIKOV (1979 to 1983) studied the material from several Russian expeditions in the Indian and Pacific Oceans. In parallel with the present report, the scaphopod fauna of Australia is being revised by Dr J. HEALY and Mr K. LAMPRELL, and it is anticipated that the two papers combined will hopefully lay new foundations for the taxonomy and biogeography of Indo-Pacific Scaphopoda. As a help for further revisionary work, I have given under each genus a list of valid Indo-Pacific taxa not critically examined by me for this paper, complete with type locality and literature references.

ABBREVIATIONS AND TEXT CONVENTIONS

For shells, usage of terms such as small, medium, long refers to the approximate mean length for specimens considered adults. Known lengths range from 9 to 180 mm in Dentaliida, and from 2 to 50 mm in Gadilida. All measurements are in mm. L = length; W = maximum diameter; m = diameter at aperture (this is not always the maximum diameter); w = minimum diameter (apex); arc = the distance of maximum concavity of the dorsal side from a line between apex and mouth. Shell terminology follows Figs 1-2.

Illustrations: in drawings of apical and oral sections, the specimens are placed dorsal side up.

Charts: distribution maps are given for all species. The star notes the type locality; in the case of questionable type locality, a question mark has been added, see text for comments. Filled circles represent locality records checked for the present paper, open circles represent records taken from the literature. Circles may represent several neighbouring localities. In the case of records in Japanese waters, I have not tried to map the distribution there in detail, since the present monograph only marginally covers that country.

Radula illustrated teeth have been taken on the middle part of the radular ribbon, avoiding both juvenile rows and rows showing wear. Radula terminology follows Figs 3-4.

Source : MNHN, Paris

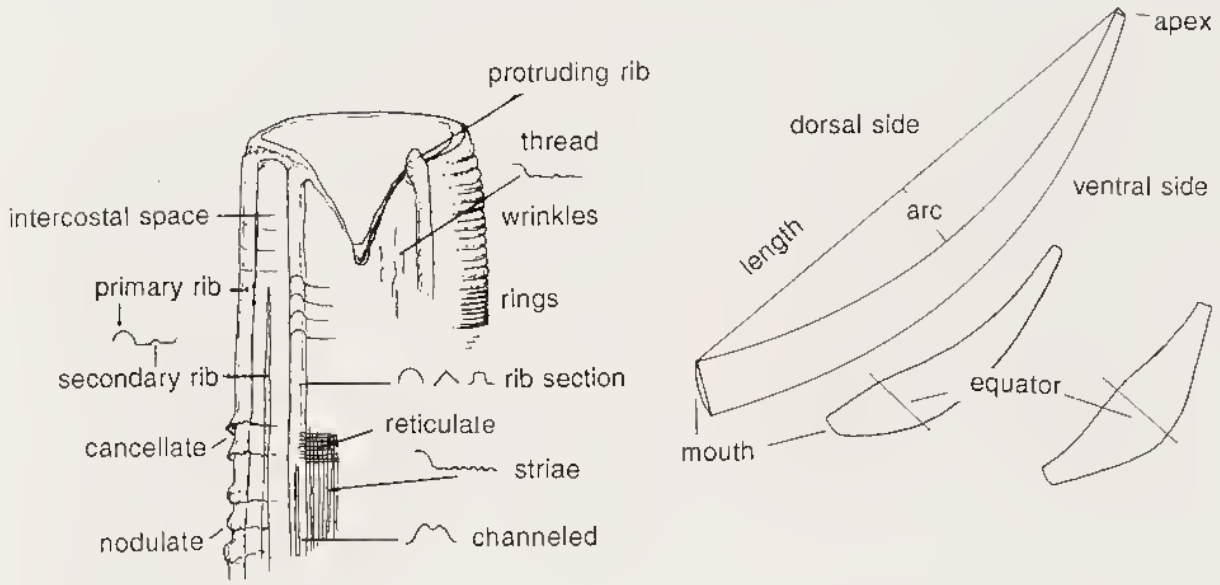


FIG. 1. — Illustrated glossary of shell structures and descriptive terms used in this publication: general shape and sculpture.

Repositories

AMNH : American Museum of Natural History, New York
AMS : Australian Musem, Sydney
ANSP : Academy of Natural Sciences of Philadelphia, Philadelphia
BMNH : The Natural History Museum, London
CNRS : Centre National de la Recherche Scientifique
IOAS : Institute of Oceanology, Academia Sinica
MHNG : Muséum d'Histoire Naturelle, Genève
MNHN : Musèum national d'Histoire naturelle, Paris
NMP : Natal Museum, Pietermaritzburg
RMNH : Nationaal Natuurhistorisches Museum, Leiden
NMNZ : Muscum of New Zealand, Wellington
NSMT : National Science Museum, Tokyo
ORSTOM : Institut Français de Recherche Scientifique pour le Développement en Coopération
SAM : South African Museum, Cape Town
USNM : National Museum of Natural History, Washington, DC
ZIN : Zoological Institute, Russian Academy of Sciences, St Petersburg
ZMB : Zoologisches Museum der Humboldt-Universität, Berlin
ZMC : Zoologisk Museum, Copenhagen

Station data

CC : Shrimp trawl
CH : Otter trawl
CP : Beam trawl
DC : Charcot dredge
DG : Boillot geological dredge
DR : Rectangular dredge (1.20 × 0.50 m)
DS : Sanders epibenthic sledge
DW : Waren dredge

Source : MNHN, Paris

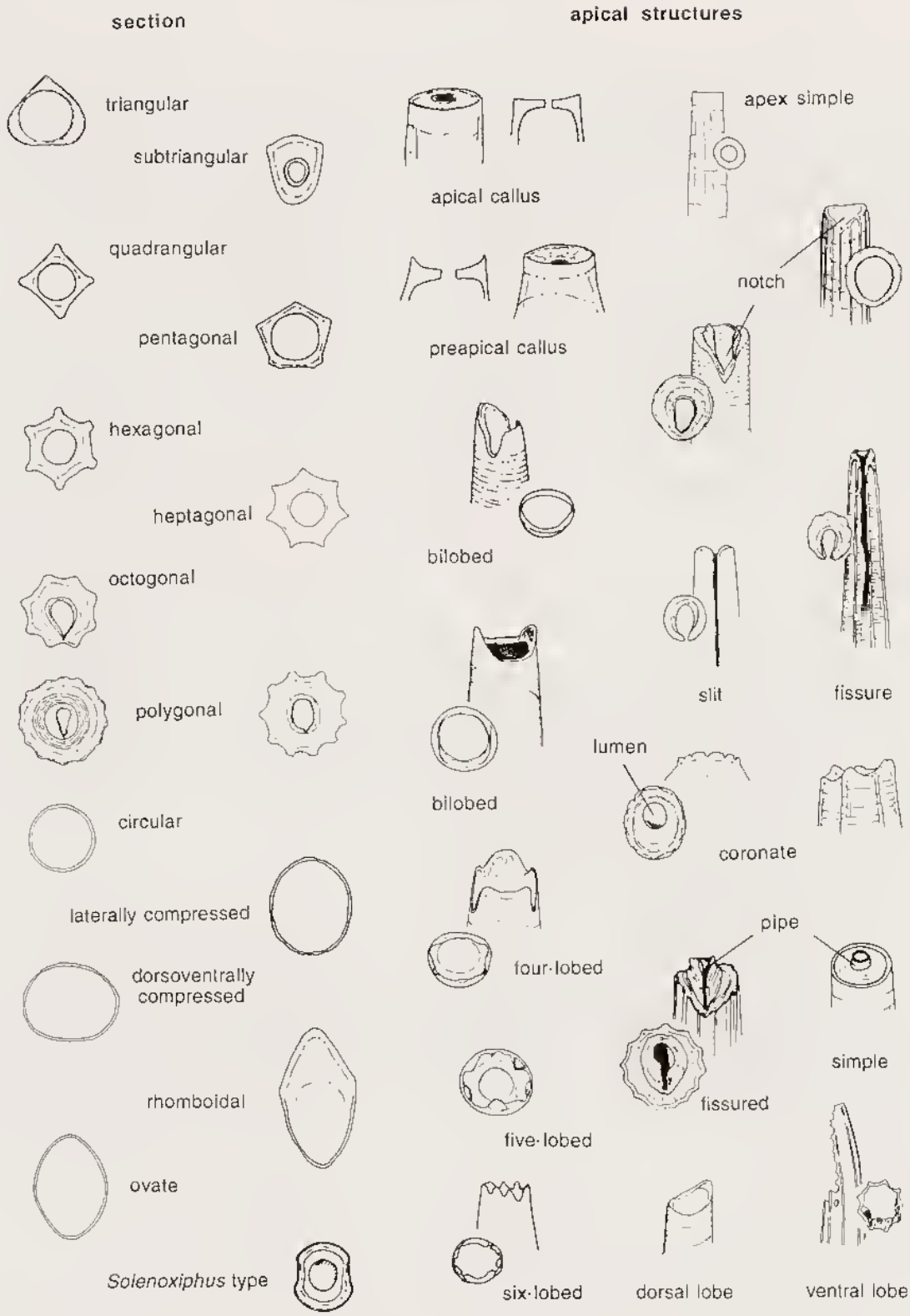


FIG. 2. — Illustrated glossary of shell structures and descriptive terms used in this publication: sections and apical structures.

Source : MNHN, Paris

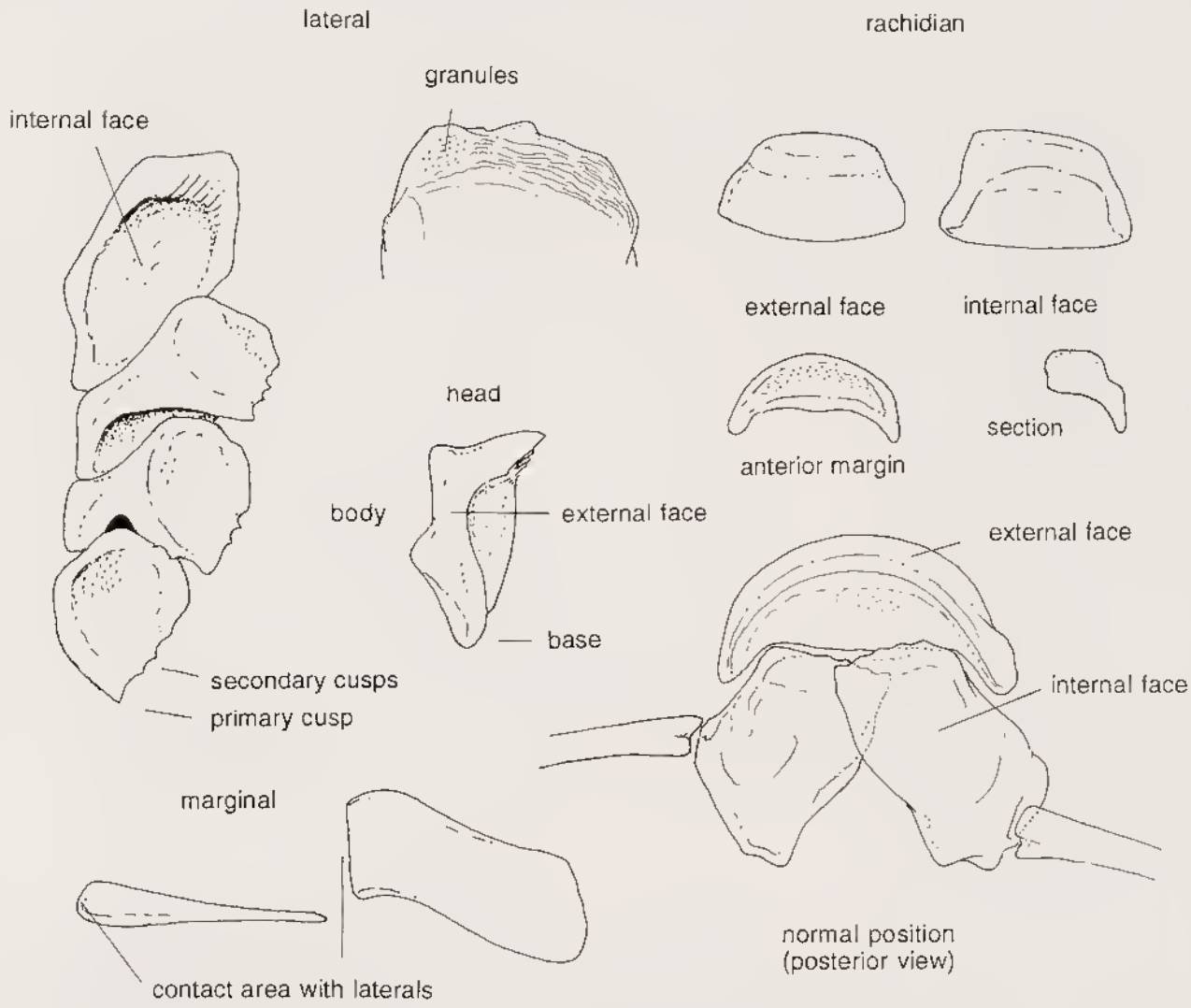


FIG. 3. — Radular nomenclature used in this publication: Dentaliida.

F : Faubert [a group of old cotton nets towed on the bottom, especially on steep hard bottoms]
KG : Usnel Box-Corer
B : Okean dredge
S : SCUBA operated air lift
stn : Station
T : Troika dredge

Other abbreviations

Coll. : collection of
coll. : collected by
lv : live-taken specimens
dd : empty shells
OD : Original designation
SD : Subsequent designation.

Source : MNHN, Paris

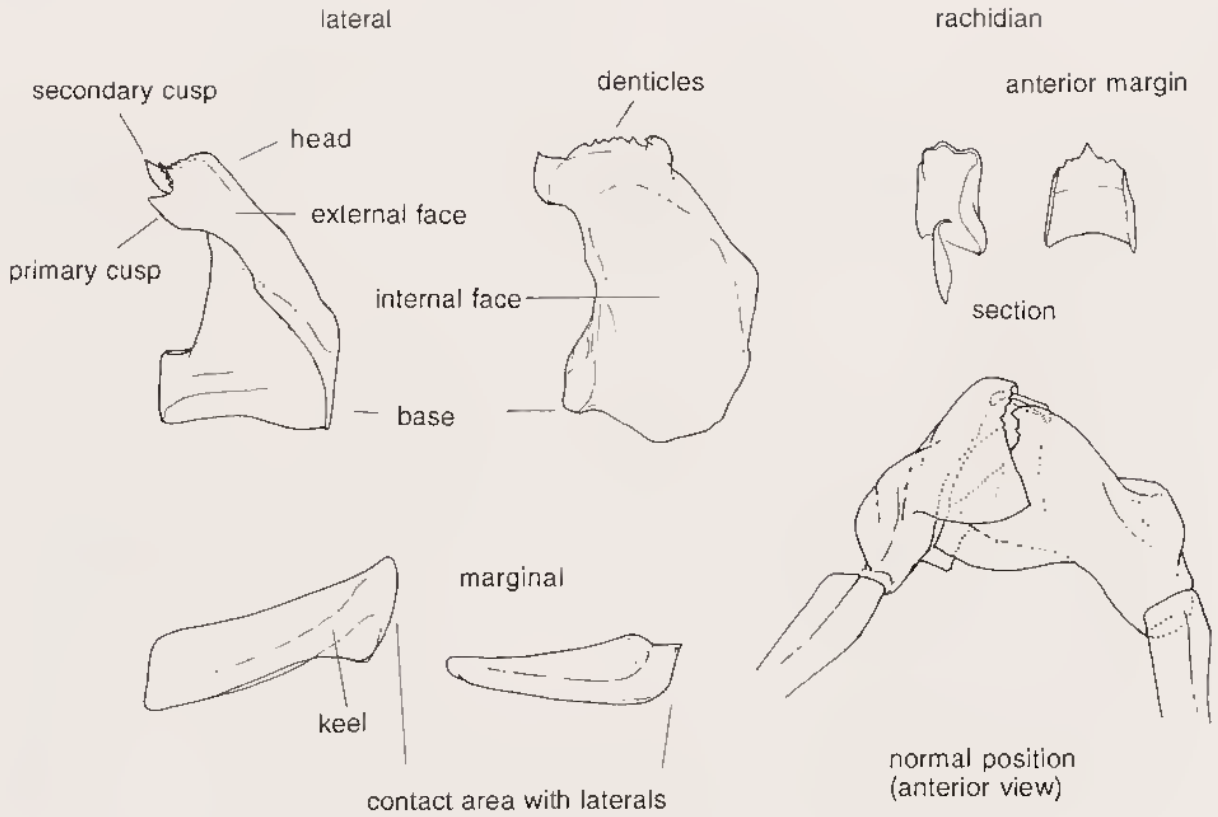


FIG. 4. — Radular nomenclature used in this publication: Gadilida.

SYSTEMATIC ACCOUNT

This paper follows, with some modifications based on unpublished information, the classification proposed by STEINER (1992b), which is currently the best approach to a biologically based ordination for the class (Table 1). Modifications proposed here are supported by radular and shell characters. For historical reviews of former classifications see EMERSON (1978) and STEINER (1992b). This latter paper as well as those of STEINER (1991 and 1992a) are recent and provide descriptions of the anatomy of representatives of genera, therefore I will here discuss only shell and radular characters, based on new, unpublished observations. (Exceptions are *Sagamicadulus* and *Eudentalium*, for which I have not had access to live-taken material). For general information about scaphopod radula, I refer to IVANOV & CHISTIKOV (1990).

Table 1. — Synopsis of the classification of Indo-Pacific Scaphopoda used in the present paper.

Class SCAPHOPODA Bronn, 1862
Order DENTALIIDA da Costa, 1776
Family DENTALIIDAE Gray, 1847
Genus *Dentalium* Linné, 1758 = *Lentigodentalium* Habe, 1963
Genus *Paradentalium* Cotton & Godfrey, 1933
Genus *Tesseracme* Pilsbry & Sharp, 1897
Genus *Eudentalium* Cotton & Godfrey, 1933
Genus *Antalis* H. & A. Adams, 1854

Source : MNHN, Paris

Genus *Plagioglypta* Pilsbry *in* Pilsbry & Sharp, 1897
Genus *Striodentalium* Habe, 1964
Genus *Graptacme* Pilsbry & Sharp, 1897
Genus *Fissidentalium* Fischer, 1885
Genus *Schizodentalium* Sowerby, 1894
Genus *Compressidentalium* Habe, 1963
Genus *Coccodentalium* Sacco, 1896
Genus *Pictodentalium* Palmer, 1974

Family CALLIODENTALIIDAE Chistikov, 1975
Genus *Calliodentalium* Habe, 1964

Family FUSTIARIIDAE Steiner, 1991
Genus *Fustiaria* Stoliczka, 1868

Family GADILINIDAE Chistikov, 1975
Subfamily GADILININAE Chistikov, 1975
Genus *Gadilina* Foresti, 1895

Subfamily EPISIPHONINAE Chistikov, 1975
Genus *Episiphon* Pilsbry & Sharp, 1897

Subfamily ANULIDENTALIINAE Chistikov, 1975
Genus *Anulidentalium* Chistikov, 1975

Family LAEVIDENTALIIDAE Palmer, 1974
Genus *Laevidentalium* Cossmann, 1888

Family OMNIGLYPTIDAE Chistikov, 1975
Genus *Omniglypta* Kuroda & Habe *in* Habe, 1953

Family RHABDIDAE Chistikov, 1975
Genus *Rhabdus* Pilbry & Sharp, 1897

Order GADILIDA Starobogatov, 1974
Suborder ENTALIMORPHA Steiner, 1992
Family ENTALINIDAE Chistikov, 1979
Subfamily ENTALININAE Chistikov, 1979
Genus *Entalina* Monterosato, 1872

Subfamily HETEROSCHISMOIDINAE Chistikov, 1982
Genus *Heteroschismoides* Ludbrook, 1960
Genus *Costentalina* Chistikov, 1982
Genus *Entalinopsis* Habe, 1957
Genus *Spadentalina* Habe, 1963
Genus *Pertusiconcha* Chistikov, 1982

Subfamily BATHOXIPHINAE Chistikov, 1983
Genus *Bathoxiphus* Pilsbry & Sharp, 1897
Genus *Rhomboxiphus* Chistikov, 1983
Genus *Solenoxiphus* Chistikov, 1983

Suborder GADILIMORPHA Steiner, 1992
Family PULSELLIDAE Scarabino *in* Boss, 1982
Genus *Pulsellum* Stoliczka, 1868
Genus *Annulipulsellum* Scarabino, 1986
Genus *Striopulsellum* gen. nov.

Source : MNHN, Paris

Family WEMERSONIELLIDAE Scarabino, 1986
Genus *Wemersoniella* Scarabino, 1986
Genus *Chistikovia* gen. nov.

Family GADILIDAE Stoliczka, 1868
Subfamily SIPHONODENTALIINAE Simroth, 1894
Genus *Siphonodentalium* M. Sars, 1859
Genus *Sagamicadulus* Sakurai & Shimazu, 1963
Genus *Striocadulus* Emerson, 1962
Genus *Polyschides* Pilsbry & Sharp, 1898
Genus *Dischides* Jeffreys, 1867

Subfamily GADILINAE Stoliczka, 1868
Genus *Cadulus* Philippi, 1844
Genus *Bathycadulus* gen. nov.
Genus *Gadila* Gray, 1847 = *Platyschides* Henderson, 1920

Families ***incertae sedis***
Genus *Megaentalina* Habe, 1963
Genus *Compressidens* Pilsbry & Sharp, 1897

In the present study, 400 species-level taxa, including synonyms, are listed or discussed: they represent 237 valid species (141 Dentaliida and 96 Gadilida), of which 139 (81 Dentaliida and 58 Gadilida) have been taken during the different expeditions here reported on. Forty-two are described as new (16 Dentaliida and 26 Gadilida), and three new genera are erected in the Order Gadilida. Of the other 97 species (65 Dentaliida and 32 Gadilida) cited from the Indo-Pacific in the literature, I have examined the type material of many in their respective repositories.

Order DENTALIIDA Da Costa, 1776

Family DENTALIIDAE Gray, 1847

Genus *DENTALIUM* Linné, 1758

Type species (SD by MONTFORT, 1810): *D. elephantinum* Linnè, 1758.

Synonym: *Lentigodentalium* Habe, 1963. Type species (OD): *Dentalium variabile* Deshayes, 1825.

DIAGNOSIS. — *Shell* medium to large, generally well curved and strong, usually polished. White to yellow, orange, red, or green. Longitudinally sculptured by 8 to 12 primary ribs of varying strength, simple or channeled. Secondary ribs variable in number, smooth or sculptured. Intercostal spaces concave or convex, smooth or sculptured by longitudinal or transversal striae, or both. Apex generally with a flat V-shaped notch on the ventral side. Apical callous, lumen circular and pipe are common. Transversal section polygonal at the apex, usually circular at the mouth.

Radula rachidian very regular, well curved in section, anterior margin smooth or granulous; lateral solid with primary cusp sharp and secundary shorts; marginal short and slightly sinusoidal.

DISTRIBUTION. — Cretaceous-Recent, worldwide; temperate to tropical; sublittoral-shelf-bathyal.

Source : MNHN, Paris

Dentalium elephantinum Linné, 1758

Figs 5, 16 a

Dentalium elephantinum Linné, 1758: 785.

Synonyms:

Dentalium arcuatum Gmelin, 1791: 3738 (after Gualtieri, 1757: pl. 10, figs G, I).
Dentalium viridis Perry, 1811: pl. 52, fig. 3.

Other references:

Dentalium elephantinum — Martini, 1769: 31, pl. 1, fig. 5a (first illustration of a live specimen). — Lister, 1770: pl. 547, fig. 1 (*pars*). — Gmelin, 1791: 3736. — Lamarck, 1801: 326. — Deshayes, 1825: 347, pl. 3, fig. 7. — Sowerby, 1860: 102, pl. 223 (*Dentalium* 1), fig. 4; 1873: pl. 1, fig. 5. — Pilsbry & Sharp, 1897: 1, pl. 1, figs 1-7. — Boissevain, 1906: 7, pl. 1, fig. 1. — Oostingh, 1925: 228. — Habe, 1962: 106, pl. 47, fig. 16; 1963: 253, pl. 37, fig. 3; 1964a: 6, pl. 1, fig. 3. — Emerson, 1962: 468, pl. 77, figs 1a-c. — Habe & Kosuge, 1964: 1. — Springsteen & Leobrera, 1985: 286, pl. 82, fig. 1. — Higo & Goto, 1993: 685.

Type material. — Syntypes, Uppsala University Zoological Museum (*fide* Wallin, 1992; not seen), and Linnean Society of London, no. 612 (*fide* Wheeler, 1993, not seen).

Type locality. — *D. elephantinum*: Amboina [Ambon], Indonesia. — *D. arcuatum*: unknown. — *D. viridis*: "South Seas".

Material examined. — **Papua New Guinea**. Manokwari, Coll. Staadt, 2 dd. — Port Dorey, Raffray coll., 4 dd (both MNHN).
Indonesia. Moluccas, Coll. Jousseaume, 3 dd (MNHN).
Philippines. Davao, Coll. Staadt, 2 dd. — Philippines, 1 dd (both MNHN).
Northern Indian Ocean. India, Coll. Denis, 1 dd. — Malabar, 2 dd (both MNHN).

Fig. 5. — Distribution of *Dentalium elephantinum*.

Distribution. — The Philippines, Indonesia, New Guinea, Northern Indian Ocean (present paper), 5-40 m (Habe, 1964a).

Source : MNHN, Paris

Dentalium aprinum Linné, 1767

Figs 6, 16 b

Deutaliuu aprinum Linné, 1767: 1263.

Synonyms:

Dentalium striatulum Gmelin, 1791: 3738 (after LISTER, 1770: pl. 574, fig. 1) (*pars*).
Dentalium interstriatum Sowerby, 1860: 102, pl. 223 (*Dentalium* 1), fig. 7.
Dentalium aprinum incolor Boissevain, 1906: 9, pl. 4, figs 3-6.
Dentaliuu aprinum taiwanum Kuroda, 1941: 149.

Other references:

Dentalium aprinum – LISTER, 1770: pl. 547, fig. 1 (*pars*). — SOWERBY, 1860: 102, pl. 223 (*Dentalium* 1), figs 5-6; 1873: pl. 1, figs 2a-b. — MARTENS, 1880: 311. — CLESSIN, 1896: 12, pl. 3, figs 1-2. — BOISSEVAIN, 1906: 9, pl. 1, fig. 3, pl. 4, fig. 2. — DAUTZENBERG, 1929: 553. — DAWYDOFF, 1952: 144. — HABE, 1963: 253, pl. 37, fig. 6; 1977: 330. — HABE & KOSUGE, 1964: 1; 1966: 117, figs 24-25. — SPRINGSTEEN & LEOBRERA, 1985: 286, pl. 82, fig. 2. — DHARMA, 1992: 79, fig. 14. — HIGO & GOTO, 1993: 685.
Dentaliuu aparinum (*sic*) – CHERIYAN, 1968: 126. — SAYTAMURTI, 1956: 4, pl. 1 figs 2 a-b.
Dentaliuu apricum (*sic*) – PAETEL, 1873: 78.
Dentalium aprinum taiwanum – HABE, 1962: 106, pl. 47, fig. 15.
Dentalium interstriatum – CLESSIN, 1896: 13, pl. 3, fig. 8. — PILSBRY & SHARP, 1897: 4, pl. 1, fig. 15.

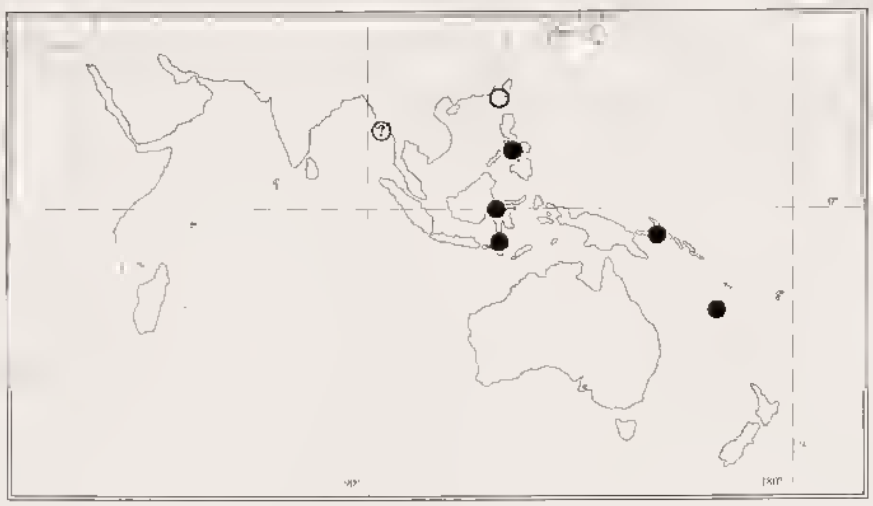


FIG. 6. — Distribution of *Deutaliuu aprinum*.

TYPE MATERIAL. — *D. aprinum*: syntypes in the Linnean Society of London, no. 611 (not seen). — *Dentalium aprinum incolor*: lectotype (here designated) ZMA 3.06.055 and paralectotypes ZMA 3.06.066-007. — *D. interstriatum*: syntypes (3 dd) BMNH 1950.11.28.42-44.

TYPE LOCALITY. — *D. aprinum*: Indian Ocean. — *D. aprinum incolor*: Indonesia, anchorage off Lirung, Silababu Island, *"Siboga"*, stn 133. — *D. aprinum taiwanum*: Taiwan, Takao. — *D. interstriatum*: Philippines, Bohol Island. — *D. striatulum*: unknown.

MATERIAL EXAMINED. — Type material of *D. aprinum incolor* and *D. interstriatum*.
New Caledonia. MUSORSTOM 4: stn DW 150, 19°07′ S, 163°22′ E, 110 m, 1 lv, 20 dd.
Papua New Guinea. New Britain, 3 dd (MNHN).

Source : MNHN, Paris

Indonesia. CORINDON: stn CH 206, 01°06′ S, 117°45′ E, 85 m, 1 dd. — Stn DR 216, 00°40′ N, 117°51′ E, 94 m, 26 dd. — Stn B 256, 01°56′ S, 119°174′ E, 24 m, 3 dd.
"Snellius" I: Timor, 123 m, 1 dd (RMNH).
Philippines. Philippines, no further data, 24 dd (MNHN).

DISTRIBUTION. — From Southern Japan, 5-40 m (HABE & KOSUGE, 1964) through Taiwan, the Philippines and Sulu Sea, to Indonesia and Papua New Guinea. Now extended to New Caledonia, alive in 110 m.

Dentalium octangulatum Donovan, 1804

Figs 7, 16 c

Dentalium octangulatum Donovan, 1804: pl. 162.

Synonyms:

Dentalium octogonum Lamarck, 1818: 344.
Dentalium yokohamense Watson, 1879: 517; 1886: 11, pl. 2, fig. 1.
Dentalium japonicum Dunker, 1882: 153, pl. 5, fig. 2.

Other references:

Dentalium octangulatum – PILSBRY & SHARP, 1898: 16, pl. 2, figs 16-18, 22. — BOISSEVAIN, 1906: 17, pl. 1, fig. 8, pl. 4, fig. 8-9. — DAUTZENBERG & FISCHER, 1906: 209. — TOKUNAGA, 1907: 10. — WINCKWORTH, 1927: 167, pl. 14, fig. 4. — KURODA & KIKUCHI, 1933: 7. — NOMURA, 1938: 155. — DAWYDOFF, 1952: 144. — SAYTAMURTI, 1956: 126. — AHMED, 1975: 29, fig. 32. — HABE, 1977: 330. — SPRINGSTEEN & LEOBRERA, 1985: 286, pl. 82, fig. 3. — QI & MA, 1989: 112, fig. 2. — IEYAMA, 1993: 245, figs 1-3.
Dentalium (*Paradentalium*) *octangulatum* – HABE, 1963: 254, pl. 37, figs 1-2; 1971: 486 (Japanese text), 305 (English text), pl. 65, figs 10-11. — HABE & KOSUGE, 1964: 1. — KIRA, 1955: 80, pl. 40, fig. 8. — HIGO & GOTO, 1993: 685.
Dentalium (*Dentalium*) *octangulatum* – HIRASE, 1931: 133, figs 1-4. — LUDBROOK, 1954: 96, fig. 1. — KIRA, 1962: 116, pl. 41, fig. 8.
Dentalium octogonum – DESHAYES, 1825: 352, pl. 16, figs 5-6. — DELESSERT, 1841: pl. 1, figs 1-1a-b. — CHENU, 1843: 4, pl. 1, figs 21-23. — REEVE, 1842b: 130, pl. 130, fig. 8. — SOWERBY, 1860: 102, pl. 223, fig. 9; 1873: pl. 2, fig. 12. — MARTENS, 1874: 102. — LISCHKE, 1874: 75, pl. 5, figs 1-3. — SMITH, 1875: 25. — BRAZIER, 1877: 55. — ANGAS, 1878: 868. — DUNKER, 1882: 153. — PILSBRY, 1895: 116. — CLESSIN, 1896: 10, pl. 1, fig. 6. — HALL & STANDEN, 1907: 65.
Dentalium octagonum – STEARNS, 1891: 13.
Dentalium (*Paradentalium*) *octangulum* – FUKUDA, 1992: 81, fig. 421.

FIG. 7. — Distribution of *Dentalium octangulatum*.

Source : MNHN, Paris

TYPE MATERIAL. — *D. octangulatum*: neotype, designated by LUDBROOK (1954), BMNH 1952.2.23.1. — *D. octogonum*: syntypes (2 dd) MNHN (one of which figured by DELESSERT, 1841). — *D. yokohamense*: syntypes (3 dd) BMNH 1887.2.9.45-47. — *D. japonicum*: holotype ZMB 101995 (*fide* KILIAS, 1995).

TYPE LOCALITY. — *D. octangulatum*: LUDBROOK (1954) designated Japan as type locality, while DONOVAN's original was China Seas. — *D. octogonum*: "Mers de la Chine". — *D. yokohamense*: Japan, Yokohama, *"Challenger"*, stn 233, 34°39′ N, 135°14′ E, 8 fms [15 m]. — *D. japonicum*: Japan.

MATERIAL EXAMINED. — The type material of *D. octangulatum*, *D. octogonum* and *D. yokohamense*.
Japan. No further data, Coll. JOUSSEAUME, 2 dd (MNHN).
China. No further data, 6 dd (MNHN).
Northern Indian Ocean. Karikal, Bay of Bengal, 4 dd (MNHN). — Persian Gulf, Dubay'ah, S. Pras coll., 20 dd (MNHN). — Jebel Dana and Abu Dhabi, 10 dd (BMNH). — Oman, Salalah, shore, 32 dd (BMNH).

DISTRIBUTION. — Japan, China Seas, Philippines, Northern Indian Ocean, Persian Gulf, shells in 0-100 m (HABE & KOSUGE, 1964).

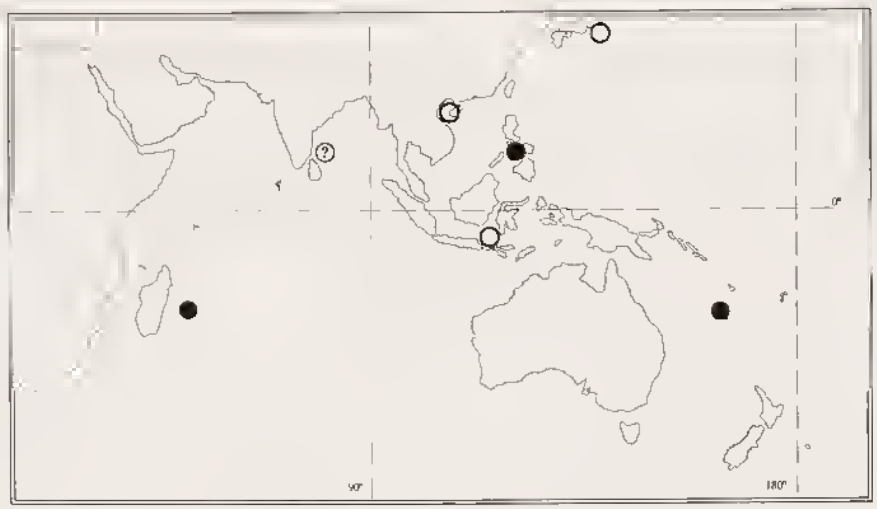


FIG. 8. — Distribution of *Dentalium elephantinum*.

Dentalium variabile Deshayes, 1825

Figs 8, 16 d-e

Dentalium variabile Deshayes, 1825: 352, pl. 2, fig. 30.

Synonyms:

Dentalium multistriatum Deshayes, 1825: 358, pl. 4, fig. 11 (**Syn. nov.**).
Dentalium belcheri Sowerby, 1860: 101, pl. 24 (*Dentalium* 2), figs 28-29 (**Syn. nov.**).

Other references:

Dentalium variabile – SOWERBY, 1860: 101, pl. 224 (*Dentalium* 2), fig. 30; 1873: pl. 4, fig. 26. – MARTENS 1887: 200. — BOISSEVAIN, 1906: 36, pl. 1, fig. 17. — CLESSIN, 1896: 14, pl. 4, fig. 1. — PILSBRY & SHARP, 1897: 60, pl. 14, figs 26-28.
Lentigodentalium variabile – HABE, 1977: 332. — HABE *et al.*, 1986: 24. — CHISTIKOV, 1979b: 112. — HIGO & GOTO, 1993: 686.
Dentalium (*Lentigodentalium*) *variabile* – HABE, 1963: 258, figs 53-54. — HABE & KOSUGE, 1964: 2.
Dentalium belcheri – SOWERBY, 1873: pl. 1, figs 1a-b. — PILSBRY & SHARP, 1897: 60, pl. 14, figs 29-30. — BOISSEVAIN, 1906: 35, pl. 1, fig. 18. — SMITH, 1906b: 58.

Source : MNHN, Paris

TYPE MATERIAL. — *D. variabile*: lectotype (here designated) (L 22.5, W 2.4, w 1.4) from 164 syntypes (MNHN). — *D. multistriatum*: lectotype (here designated) (L 18.8, W 2, w 1) from 14 syntypes (MNHN). — *D. belcheri*: lectotype (here designated) the largest (25 mm) of the 3 syntypes BMNH.

TYPE LOCALITY. — *D. variabile*: "could be from India". — *D. multistriatum*: "presumably from India" (DESHAYES 1825). — *D. belcheri*: East Indian Archipelago [= Indonesia].

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. CHALCAL 1: stn DC 40, 20°32′ S, 158°51′ E, 65 m, 1 dd.
New Caledonia. LAGON: stn 7, 22°24′ S, 166°20′ E, 14 m, 7 dd. — Stn 8, 22°23′ S, 166°18′ E, 15 m, 1 dd. — Stn 21, 22°23′ S, 166°23′ E, 10 m, 1 dd. — Stn 50, 22°17′ S, 166°12′ E, 12 m, 1 lv, 2 dd. — Stn 64, 22°28′ S, 166°25′ E, 15 m, 2 lv. — Stn 98, 22°36′ S, 166°32′ E, 15 m, 1 lv. — Stn 162, 22°13′ S, 166°09′ E, 10 m, 4 lv. — Stn 212, 21°56′ S, 165°53′ E, 10 m, 2 lv, 1 dd. — Stn 214, 21°55′ S, 165°48′ E, 12 m, 4 dd. — Stn 293, 22°42′ S, 166°41′ E, 20 m, 1 lv. — Stn 867, 20°39′ S, 165°01′ E, 25 m, 1 dd.
Philippines. No further data, 11 dd. — *ibid.*, Coll. JOUSSEAUME, 73 dd, (all MNHN).
West Indian Ocean. MD 32 Réunion: stn DC 85, 21°00′ S, 55°15′ E, 58-70 m, 60 dd. — Stn DC 86, 20°59′ S, 55°15′ E, 75-90 m, 7 dd.

DISTRIBUTION. — Japan, China Seas, the Philippines, Indonesia and India (?), now extended to New Caledonia and Réunion Island, alive in 10-75 m (present paper).

Dentalium strigatum Gould, 1859

Figs 9, 16 f

Dentalium strigatum Gould, 1859: 166.

Synonym:

Dentalium agulhasense Plate, 1908a: 349, pl. 30, figs 21-23 (**Syn. nov.**).

Other references:

Dentalium strigatum — SMITH, 1903: 393. — BARTSCH, 1915: 180, pl. 44, fig. 5. — TOMLIN, 1931: 337. — JAECKEL, 1932: 303. — BARNARD, 1963b: 345; 1974: 742. — JOHNSON, 1964: 153.

FIG. 9. — Distribution of *Dentalium strigatum*.

Source : MNHN, Paris

TYPE MATERIAL. — *D. strigatum*: lectotype (designated by JOHNSON, 1964) USNM 159, paralectotypes MCZ 169382. — *D. agulhasense*: lectotype, designated by KILIAS (1995), ZMB 61087a.

TYPE LOCALITY. — *D. strigatum*: False Bay, Cape of Good Hope, 20-80 m. — *D. agulhasense*: South Africa, off Cape Agulhas, *"Valdivia"*, stn 95, 34°51′ S, 19°38′ E, 80 m.

MATERIAL EXAMINED. — The type material of *D. strigatum*.
West Indian Ocean. MD 32 Réunion: stn CP 172, 20°52′ S, 55°38′ E, 105-120 m, 1 dd.
"Meiring Naudé": stn SM 180, 33°29′ S, 27°21′ E, 80 m, 2 dd (SAM).

DISTRIBUTION. — South Africa, Mozambique Channel (BARNARD, 1963b); now extended to Réunion Island; shells in 80-120 m.

Dentalium bisexangulatum Sowerby, 1860

Figs 10, 16 j

Dentalium bisexangulatum Sowerby, 1860: 102, pl. 223 (*Dentalium* 1), fig. 8.

Other references:

Dentalium bisexangulatum – SOWERBY, 1873: pl. 3, fig. 15. — BRAZIER, 1877: 57. — COOKE, 1885: 273. — PILSBRY & SHARP, 1897: 15, pl. 2, fig. 25. — BOISSEVAIN, 1906: 22, pl. 1, fig. 7.
Dentalium (Dentalium) bisexangulatum – LUDBROOK, 1954: 92. — HIGO & GOTO, 1993: 685.
D. (P.) bisexangulatum – HABE & KOSUGE, 1964: 2.

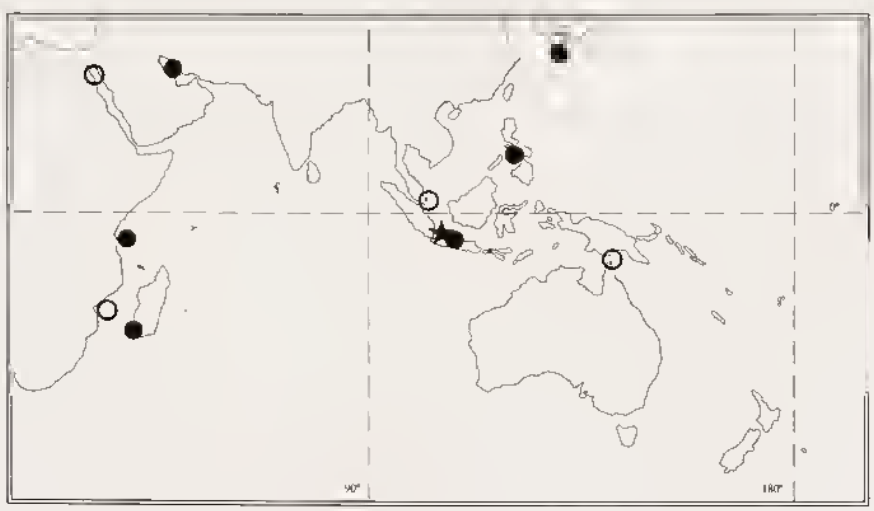


FIG. 10. — Distribution of *Dentalium bisexangulatum*.

TYPE MATERIAL. — 3 syntypes dd, BMNH no reg. no.

TYPE LOCALITY. — Java.

MATERIAL EXAMINED. — The type material.
Indonesia. Java, Coll. JOUSSEAUME, 1 dd (MNHN).
Philippines. Philippines, Coll. JOUSSEAUME, 1 dd (MNHN).
Japan. Booshu, Coll. DENIS, 1945, 2 dd (MNHN).

Source : MNHN, Paris

Northwestern Indian Ocean. Persian Gulf, shore of Iran, 26°35′ N, 54°00′ E, 35 m, 2 dd, *"Calypso"* 1954 (MNHN).
West Indian Ocean. Madagascar, Tuléar, N of jetty, shore, 10 dd. — Tuléar, Grand Récif, 1 m, 4 dd, R. v. Cosel coll. 1986. — Zanzibar, Coll. CLOUÉ, 1850, 5 dd (MNHN).

DISTRIBUTION. — Japan, Singapore, Java, Torres Strait, Gulf of Suez, Mozambique (14-55 m) (LUDBROOK, 1954); Philippines, Persian Gulf, Zanzibar (present paper). No data about living depth range.

Dentalium javanum Sowerby, 1860

Figs 11, 16 i

Dentalium javanum Sowerby, 1860: 102, pl. 223 (*Dentalium* 1), fig. 12.

Other references:

Dentalium javanum – SOWERBY, 1873: pl. 3, fig. 14. — SMITH, 1884: 77. — PILSBRY & SHARP, 1897: 4, pl. 4, fig. 49. — MELVILL & STANDEN, 1899: 181. — BOISSEVAIN, 1906: 18, pl. 1, fig. 6; pl. 4, fig. 7. textfig. 13. — HABE, 1977: 331.
Dentalium (*Paradentalium*) *javanum* – HABE, 1963: 254, pl. 37, figs 7-8; 1964a: 9, pl. 1, figs 7-8.
Dentalium (*Paradentalium*) *javanicum* – HIGO & GOTO, 1993: 685.

TYPE MATERIAL. — Not found in BMNH.

TYPE LOCALITY. — Java, Malacca.

MATERIAL EXAMINED. — **Indonesia**. "Java, Malacca", Coll. WRIGHT 1869, 2 dd. — Java, Coll. JOUSSEAUME, 1 dd (both MNHN).

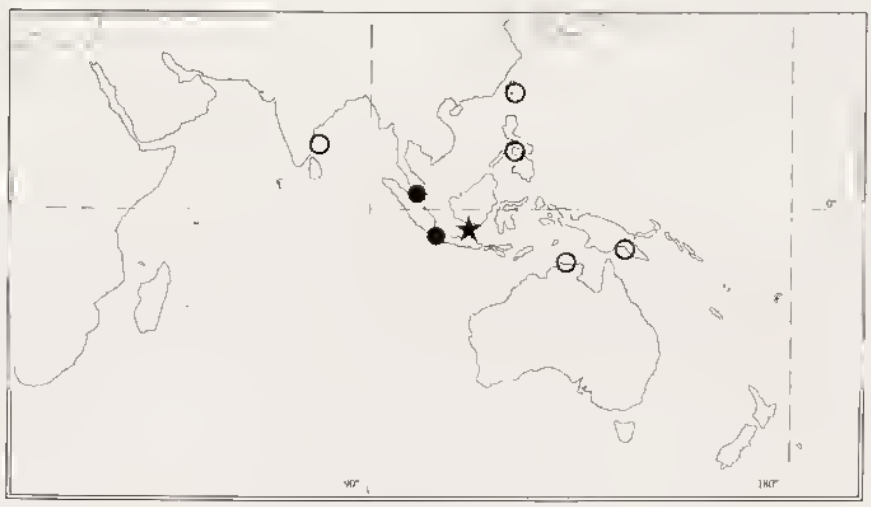


FIG. 11. — Distribution of *Dentalium javanum*.

DISTRIBUTION. — Taiwan, Philippines, Indonesia, New Guinea, North Australia, India, 5-50 m (HABE, 1964b).

Source : MNHN, Paris

Dentalium reevei Fischer, 1871

Figs 12, 16 g-h

Dentalium reevei Fischer (*ex* Deshayes, MS), 1871: 212.

Synonyms:

Dentalium aratorum Cooke, 1885: 273.
Dentalium lineolatum Cooke, 1885: 274.
Dentalium clavus Cooke, 1885: 275.
Dentalium langieri Jousseaume, 1894: 103.
Dentalium macandrewi Boissevain, 1906: 25, pl. 5, figs 25-34.

Other references:

Dentalium reevei – Boissevain, 1906: 27. — Moazzo, 1939: 221.
Dentalium (Dentalium) reevei – Ludbrook, 1954: 98.
Dentalium aratorum – Pilsbry & Sharp, 1897: 10. — Boissevain, 1906: 27, pl. 5, figs 31-34. — Franc, 1956: 49.
Dentalium lineolatum – Pilsbry & Sharp, 1897: 11. — Boissevain, 1906: 26. pl. 5, figs 25-27. — Lamy, 1910: 334; 1938: 88. — Dautzenberg, 1929: 554.
Dentalium laugieri – Pilsbry & Sharp, 1897: 12. — Boissevain, 1906: 25.
Dentalium clavus – Boissevain, 1906: 27, pl. 5, figs 28-30.

Fig. 12. — Distribution of *Dentalium reevei*.

Type material. — *D. reevei*: lectotype (here designated), the only remaining syntype, MNHN. — *D. laugieri*: 10 syntypes dd MNHN. — *D. macandrewi*: lectotype (here designated), the specimen figured in Boissevain, 1906, pl. 5, fig. 29 (ZMA). — *D. aratorum*, *D. lineolatum* and *D. clavus*: not located.

Type locality. — *D. reevei*: Suez. — *D. aratorum*, *D. lineolatum* and *D. clavus*: Gulf of Suez. — *D. laugieri*: Aden, Suez. — *D. macandrewi*: Gulf of Suez.

Material examined. — The type material listed.
Northwestern Indian Ocean. Red Sea: Saudi Arabia, 24°12′ N, 37°55′ E, Marioni coll., 2 dd. — Port Sudan, harbour, 1 m, Reid coll., 9 lv, 1 dd (both BMNH). — Souakin, Sudan, 1 dd. — Aden, 2 dd (both Coll. Jousseaume, MNHN).
West Indian Ocean. BENTHEDI: stn S 18, 12°45′ S, 45°16′ E, 15 m, 1 lv, 6 dd. — Stn S 23, 12°46′ S,

Source : MNHN, Paris

45°15′ E, 6 m, 1 lv, 1 dd. — Stn S 32, 12°45′ S, 45°18′ E, 15-20 m, 1 dd. — Stn S 36, 12°52′ S, 45°16′ E, 30 m, 2 dd.
Shimoni, Kenya, 2 lv, 5 dd. — 1 mile E Nyango, W Zanzibar, 18 fms [33 m], 1 dd (both BMNH). — Kiloa, Zanzibar, 3 dd. — Tuléar, Madagascar, 2 dd. — Tuléar, S beach, Thomassin coll., 1 dd (all MNHN). — Nosy Bé Island, NW Madagascar, 5 m, 2 lv, Plante coll. (BMNH).

DISTRIBUTION. — Red Sea and the Gulf of Aden; now extended to East Africa and Madagascar, alive in 6-32 m.

REMARKS. — Although BOISSEVAIN (1906) introduced the name *D. macandrewi* as a *nomen novum* for *D. aratorum*, *D. lineolatum* and *D. clavus*, none of the Cooke's names is preoccupied. *D. macandrewi* is to be treated as a nominally different species, with its own type material. *D. reevei* is extremely variable in shape (W/w ratio 3.5-1.5) and colour (white to green). The ribs can be simple to deeply channeled longitudinally, smooth to slightly sculptured transversally. The apex is also variable in width, probably due to reabsorption.

Dentalium oryx Boissevain, 1906

Figs 13, 16 k, 71 d

Dentalium oryx Boissevain, 1906: 20, pl. 6, fig. 24.

Synonym:

Dentalium paucicontortum Boissevain, 1906: 28, pl. 6, figs 25-28 (**Syn. nov.**).

Other references:

Entalinopsis (*Entalinospsis*) *oryx* — HABE & KOSUGE, 1964: 9.
Dentalium (*Paradentalium*) *paucicontortum* — HABE, 1963: 255.

TYPE MATERIAL. — *D. oryx*: lectotype (here designated) ZMA 3.06.014, paralectotypes ZMA 3.06.015. — *D. paucicontortum*: lectotype (here designated) ZMA 3.06.022, paralectotypes ZMA 3.06.023.024.

TYPE LOCALITY. — *D. oryx*: *"Siboga"*, stn 302, 10°28′ S, 123°29′ E, 216 m, South of Sunda Island. — *D. paucicontortum*: Indonesia, Sulu Archipelago, *"Siboga"*, stn 95, 05°44′ N, 119°40′ E, 522 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 306, 22°08′ S, 159°21′ E, 375-415 m, 1 lv, 1 dd. — Stn DW 340, 19°49′ S, 158°41′ E, 675-680 m, 1 dd. — Stn DW 341, 19°46′ S, 158°43′ E, 620-630 m, 1 lv, 1 dd. — Stn DW 357, 19°37′ S, 158°46′ E, 630 m, 6 dd. — Stn DW 358, 19°39′ S, 158°47′ E, 680-700 m, 1 dd. — Stn DC 361, 19°53′ S, 158°38′ E, 400 m, 1 dd. — Stn DC 362, 19°53′ S, 158°40′ E, 410 m, 1 lv. — Stn DC 381, 19°38′ S, 158°47′ E, 620 m, 1 dd. — Stn DC 382, 19°37′ S, 158°43′ E, 580 m, 1 dd.
New Caledonia. *"Vauban"* 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 28 dd.
BIOCAL: stn DW 36, 23°09′ S, 167°11′ E, 650-680 m, 1 dd. — Stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 4 dd. — Stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 3 lv, 4 dd. — Stn DW 70, 23°25′ S, 167°53′ E, 965 m, 1 lv.
MUSORSTOM 4: stn DW 226, 22°47′ S, 167°22′ E, 390 m, 1 dd.
CHALCAL 2: stn DW 72, 24°55′ S, 168°22′ E, 527 m, 2 lv.
LAGON: stn 993, 20°15′ S, 163°53′ E, 375-400 m, 2 dd.
Passe de Boulari, 400 m, B. Richer/ORSTOM coll., 6 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 397, 20°47′ S, 167°05′ E, 380 m, 1 dd. — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 1 dd. — Stn DW 416, 20°42′ S, 167°00′ E, 343 m, 1 dd. — Stn DW 418,

Source : MNHN, Paris

20°42′ S, 167°03′ E, 283 m, 1 dd. — Stn DW 425, 20°24′ S, 166°25′ E, 594 m, 3 dd. — Stn DW 439, 20°46′ S, 167°17′ E, 288 m, 3 dd. — Stn DW 440, 20°49′ S, 167°17′ E, 288 m, 2 dd. — Stn DW 451, 20°59′ S, 167°25′ E, 330 m, 3 dd. — Stn DW 452, 21°00′ S, 167°25′ E, 300 m, 1 dd. — Stn DW 481, 21°22′ S, 167°50′ E, 300 m, 3 dd. — Stn DW 485, 21°23′ S, 167°59′ E, 350 m, 2 dd. — Stn DW 487, 21°23′ S, 167°46′ E, 500 m, 2 dd. — Stn DW 488, 20°49′ S, 167°06′ E, 800 m, 1 lv, 1 dd.

Indonesia. CORINDON: stn B 248, 00°54′ S, 119°29′ E, 170 m, 3 dd.

"Snellius" II: stn 4.166, 06°26′ S, 120°27′ E, 300 m, 5 dd.

Philippines. MUSORSTOM 3: stn DR 126, 11°49′ N, 121°22′ E, 266 m, 1 dd.

West Indian Ocean. BENTHEDI: stn DR 08, 11°29′ S, 47°18′ E, 250 m, 3 lv, 2 dd. — Stn DS 10, 11°29′ S, 47°18′ E, 440 m, 1 dd. — Stn F 49, 12°55′ S, 44°59′ E, 300-450 m, 1 lv. — Stn DR 34, 12°54′ S, 45° 16′ E, 500 m, 1 lv. — Stn 37, 12°54'S, 45°16′ E, 520-830 m, 1 dd. — Stn DS 64, 12°41′ S, 44°57′ E, 770-860 m, 3 lv. — Stn DR 104, 11°26′ S, 47°22′ E, 330-530 m, 2 lv, 1 dd. — Stn DS 120, 11°30′ S, 47°25′ E, 335-390 m, 2 dd.

MD 32 Réunion: stn DR 62, 21°09′ S, 55°12′ E, 630-710 m, 46 dd.

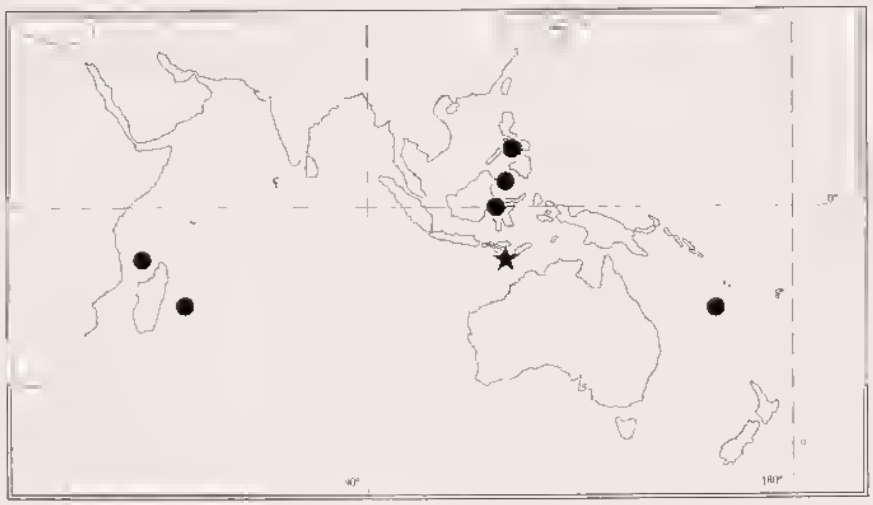


FIG. 13. — Distribution of *Dentalium oryx*.

DISTRIBUTION. — Indonesia; now extended to the Philippines, New Caledonia, and SW Indian Ocean; alive in 216-965 m.

Dentalium leucoryx Boissevain, 1906

Figs 14, 16 I

Dentalium leucoryx Boissevain, 1906: 20, pl. 6, fig. 23.

Synonym:

Dentalium sinuosum Boissevain, 1906: 28, pl. 6, fig. 22 (**Syn. nov.**).

Other references:

Dentalium leucoryx — HABE & KOSUGE, 1964: 2.
Dentalium sinuosum — HABE & KOSUGE, 1964: 2. — QI & MA, 1989: 112, fig. 1.
Paradentalium sinuosum — CHISTIKOV, 1979b: 109.

TYPE MATERIAL. — *D. leucoryx*: lectotype (here designated) ZMA 3.06.016, paralectotypes ZMA 3.06.017. — *D. sinuosum*: lectotype (here designated) ZMA 3.06.021, paralectotypes ZMA 3.06.018-020.

Source : MNHN, Paris

TYPE LOCALITY. — *D. leucoryx*: Indonesia, off Sunda Island, *"Siboga"*, stn 285, 08°39′ S, 127°04′ E, 34 m. — *D. sinuosum*: Indonesia, Timor Sea, *"Siboga"*, stn 294, 10°12′ S, 124°27′ E, 73 m.

MATERIAL EXAMINED. — The type material.
Indonesia. CORINDON: stn B 207, 00°15′ S, 117°52′ E, 150 m, 8 dd. — Stn CH 208, 00°15′ S, 117°52′ E, 150 m, 1 lv. — Stn CH 214, 00°31′ N, 117°50 E, 595 m, 2 dd. — Stn B 251, 00°54′ S, 119°30′ E, 65 m, 2 dd.
"Snellius" I: stn 123, 10°29′ S, 126°44′ E, 250 m, 1 dd.
"Snellius" II: stn 4.045, 05°57′ S, 123°49′ E, 250-300 m, 3 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 600-800 m, 1 dd.

FIG. 14. — Distribution of *Dentalium leucoryx*.

DISTRIBUTION. — South China Seas to Indonesia, alive in 150-157 m, shells from 34 m (BOISSEVAIN, 1906) to 800 m (present paper; possibly washed down).

Dentalium pluricostatum Boissevain, 1906

Figs 15, 16 m, 28 k

Dentalium pluricostatum Boissevain, 1906: 30, pl. 6, figs 6-7.

Other reference:
D. pleuricostatum (*sic*) — HABE & KOSUGE, 1964: 2.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.027, paralectotypes ZMA 3.06.025-026.

TYPE LOCALITY. — Indonesia, Buton Strait, *"Siboga"*, stn 204, 04°20′ S, 122°58′ E, 75-94 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. LAGON: stn 69, 22°23′ S, 166°32′ E, 13 m, 4 lv, 8 dd. — Stn 131, 22°28′ S, 166°50′ E, 38 m, 1 lv, 2 dd. — Stn 133, 22°24′ S, 166°52′ E, 59-62 m, 1 dd. — Stn 146, 22°24′ S, 166°55′ E, 40-

Source : MNHN, Paris

52 m, 2 lv, 3 dd. — Stn 147, 22°26′ S, 166°54′ E, 50-60 m, 5 dd. — Stn 149, 22°29′ S, 166°51′ E, 48 m, 2 lv, 4 dd. — Stn 234, 22°33′ S, 166°51′ E, 56 m, 6 lv, 12 dd. — Stn 234bis, 22°33′ S, 166°51′ E, 60 m, 2 dd. — Stn 235, 22°31′ S, 166°52′ E, 70 m, 1 lv, 3 dd. — Stn 236, 22°29′ S, 166°54′ E, 67 m, 2 lv, 3 dd. — Stn 237, 22°27′ S, 166°55′ E, 62 m, 1 dd. — Stn 238, 22°26′ S, 166°56′ E, 50 m, 1 lv. — Stn 240, 22°23′ S, 166°59′ E, 42 m, 2 dd. — Stn 245, 22°27′ S, 166°58′ E, 62 m, 3 lv, 5 dd. — Stn 257, 22°22′ S, 166°20′ E, 9 m, 1 lv. — Stn 301, 22°35′ S, 166°52′ E, 46 m, 1 lv. — Stn 317, 22°33′ S, 166°53′ E, 66 m, 1 lv, 2 dd. — Stn 318, 22°34′ S, 166°55′ E, 71 m, 1 lv, 3 dd. — Stn 319, 22°32′ S, 166°57′ E, 75 m, 3 lv, 3 dd. — Stn 320, 22°32′ S, 166°54′ E, 70 m, 1 lv, 2 dd. — Stn 321, 22°30′ S, 166°56′ E, 70 m, 1 lv. — Stn 322, 22°30′ S, 166°58′ E, 71 m, 1 lv, 20 dd. — Stn 323, 22°29′ S, 166°59′ E, 80 m, 1 dd. — Stn 325, 22°27′ S, 167°01′ E, 75 m, 4 lv, 2 dd. — Stn 326, 22°26′ S, 167°02′ E, 67 m, 4 lv, 18 dd. — Stn 328, 22°27′ S, 167°03′ E, 72 m, 3 lv, 2 dd. — Stn 329, 22°29′ S, 167°02′ E, 80 m, 7 lv, 4 dd. — Stn 330, 22°31′ S, 167°00′ E, 82 m, 1 lv, 3 dd. — Stn 331, 22°33′ S, 166°59′ E, 79 m, 3 lv, 3 dd. — Stn 332, 22°34′ S, 166°57′ E, 80 m, 3 lv, 1 dd. — Stn 333, 22°37′ S, 166°56′ E, 71 m, 7 lv. — Stn 350, 22°39′ S, 166°57′ E, 67 m, 4 lv, 6 dd. — Stn 352, 22°35′ S, 166°60′ E, 82 m, 3 lv, 7 dd. — Stn 354, 22°32′ S, 167°02′ E, 78 m, 7 lv, 3 dd. — Stn 355, 22°30′ S, 167°04′ E, 82 m, 5 lv, 1 dd. — Stn 356, 22°29′ S, 167°05′ E, 78 m, 4 lv, 3 dd. — Stn 357, 22°30′ S, 167°07′ E, 77 m, 3 lv, 5 dd. — Stn 359, 22°33′ S, 167°04′ E, 74 m, 3 lv. — Stn 361, 22°36′ S, 167°02′ E, 78 m, 1 lv. — Stn 362, 22°38′ S, 167°00′ E, 83 m, 1 dd. — Stn 376, 22°34′ S, 167°06′ E, 75-76 m, 1 lv, 11 dd. — Stn 386, 22°37′ S, 167°09′ E, 128 m, 1 lv. — Stn 429, 22°40′ S, 167°15′ E, 95 m, 6 lv. — Stn 537, 19°07′ S, 163°22′ E, 200 m, 3 dd. — Stn 538, 19°07′ S, 163°21′ E, 195 m, 1 lv, 7 dd. — Stn 539, 19°05′ S, 163°17′ E, 240 m, 2 lv, 2 dd. — Stn 603, 22°16′ S, 167°05′ E, 78-80 m, 1 lv, 6 dd. — Stn 604, 22°14′ S, 167°04′ E, 80 m, 10 lv, 10 dd. — Stn 605, 22°15′ S, 167°02′ E, 65-70 m, 4 lv. — Stn 606, 22°13′ S, 167°01′ E, 46-48 m, 1 lv. — Stn 611, 22°09′ S, 166°59′ E, 56-57 m, 1 dd. — Stn 615, 22°07′ S, 166°57′ E, 56-60 m, 3 lv. — Stn 618, 22°05′ S, 166°56′ E, 53-58 m, 1 dd. — Stn 619, 22°03′ S, 166°54′ E, 27-42 m, 1 lv. — Stn 622, 22°02′ S, 166°53′ E, 67 m, 3 lv, 5 dd. — Stn 628, 22°00′ S, 166°49′ E, 55-56 m, 1 lv, 1 dd. — Stn 630, 21°59′ S, 166°46′ E, 60-68 m, 2 lv, 1 dd. — Stn 638, 21°56′ S, 166°40′ E, 56-58 m, 2 lv. — Stn 643, 21°53′ S, 166°40′ E, 56-66 m, 3 lv, 8 dd. — Stn 646, 21°52′ S, 166°38′ E, 66-70 m, 5 lv, 4 dd. — Stn 647, 21°54′ S, 166°37′ E, 50-52 m, 3 lv, 3 dd. — Stn 648, 21°53′ S, 166°35′ E, 22-25 m, 1 dd. — Stn 649, 21°51′ S, 166°37′ E, 64-65 m, 3 lv, 7 dd. — Stn 652, 21°50′ S, 166°35′ E, 55-62 m, 6 dd. — Stn 655, 21°48′ S, 166°31′ E, 35-40 m, 2 lv. — Stn 656, 21°49′ S, 166°33′ E, 30-40 m, 1 lv. — Stn 660, 21°47′ S, 166°33′ E, 48-52 m, 1 dd. — Stn 665, 21°45′ S, 166°28′ E, 40-42 m, 1 lv, 1 dd. — Stn 674, 21°38′ S, 166°23′ E, 48 m, 1 dd. — Stn 692, 21°32′ S, 166°12′ E, 44-48 m, 1 dd. — Stn 694, 21°32′ S, 166°10′ E, 45-47 m, 2 lv. — Stn 695, 21°31′ S, 166°11′ E, 54-55 m, 1 lv, 1 dd. — Stn 699, 21°31′ S, 166°08′ E, 50-52 m, 1 dd. — Stn 712, 21°25′ S, 166°00′ E, 47-49 m, 2 lv. — Stn 728, 21°21′ S, 165°52′ E, 43-47 m, 2 lv, 2 dd. — Stn 737, 22°08′ S, 166°59′ E, 49-50 m, 1 lv. — Stn 738, 22°10′ S, 167°00′ E, 59-61 m, 1 lv. — Stn 749, 21°18′ S, 165°18′ E, 49 m, 1 dd. — Stn 768, 21°14′ S, 165°39′ E, 28 m, 1 dd. — Stn 785, 21°08′ S, 165°33′ E, 37 m, 1 dd. — Stn 791, 21°07′ S, 165°31′ E, 33 m, 1 dd. — Stn 809, 20°56′ S, 165°28′ E, 34 m, 1 dd. — Stn 813, 22°51′ S, 165°25′ E, 47 m, 1 lv. — Stn 814, 21°56′ S, 165°26′ E, 38-50 m, 1 lv, 1 dd. — Stn 815, 21°54′ S, 165°27′ E, 32 m, 2 lv. — Stn 821, 20°52′ S, 165°23′ E, 32 m, 1 dd. — Stn 827, 20°52′ S, 165°18′ E, 53 m, 1 dd. — Stn 831, 20°50′ S, 165°18′ E, 73 m, 1 dd. — Stn 832, 20°51′ S, 165°13′ E, 32 m, 1 lv. — Stn 833, 20°50′ S, 165°18′ E, 52-70 m, 2 lv, 2 dd. — Stn 834, 20°48′ S, 165°16′ E, 58 m, 1 dd. — Stn 878, 20°32′ S, 164°48′ E, 54 m, 2 dd. — Stn 901, 20°13′ S, 164°22′ E, 22-40 m, 1 lv.

MUSORSTOM 4: stn DW 149, 19°08′ S, 163°23′ E, 155 m, 3 lv, 70 dd. — Stn DW 150, 19°07′ S, 163°23′ E, 110 m, 6 lv, 18 dd. — Stn DW 151, 19°07′ S, 163°22′ E, 200 m, 1 lv, 10 dd. — Stn DW 186, 19°07′ S, 163°30′ E, 190 m, 1 dd. — Stn DW 203, 22°36′ S, 167°05′ E, 105-110 m, 1 lv. — Stn DW 232, 22°29′ S, 167°05′ E, 77 m, 1 lv.

Loyalty Islands. MUSORSTOM 6: stn DW 441, 20°54′ S, 167°17′ E, 80 m, 1 dd. — Stn DW 442, 20°54′ S, 167°17′ E, 200 m, 1 lv, 10 dd.

Philippines. MUSORSTOM 2: stn DG 32, 13°40′ N, 120°54′ E, 192-220 m, 1 dd.

MUSORSTOM 3: stn DR 140, 11°43′ N, 122°34′ E, 93-99 m, 14 dd.

Source : MNHN, Paris

West Indian Ocean. BENTHEDI: stn DR 38, 12°55′ S, 45°16′ E, 200-500 m, 1 dd. — Stn F 49, 12°55′ S, 44°57′ E, 300-450 m, 1 dd.

FIG. 15. — Distribution of *Dentalium pluricostatum*.

DISTRIBUTION. — The Philippines and Indonesia, now extended to New Caledonia and NW Madagascar; living from 9 to 240 m, shells down to 500 m (present paper).

Dentalium caledonicum sp. nov.

Figs 17, 28 a, 71 c

TYPE MATERIAL. — Holotype and 2 paratypes, MNHN.

TYPE LOCALITY. — New Caledonia, Northern Norfolk Ridge, CHALCAL 2, stn DW 74, 24°40′ S, 168°38′ E, 650 m.

MATERIAL EXAMINED. — **New Caledonia**. CHALCAL 2: stn DW 73, 24°40′ S, 168°38′ E, 573 m. 1 lv (paratype). — Stn DW 74, 24°40′ S, 168°38′ E, 650 m, 1 lv (holotype). — Stn DW 75, 24°39′ S, 168°40′ E, 600 m, 1 lv (paratype).

DISTRIBUTION. — SE New Caledonia, alive in 573-650 m.

DESCRIPTION. — *Shell* to 30 mm long, nearly straight, shiny white, solid, 15 primary ribs with rounded edges. Secondary ribs present on the dorsal side or with only vestigal undulations reaching the fragile, circular oral aperture. Apex simple, truncate, with a shallow V-shaped notch in the ventral side. Lumen circular, suboval at the end of a short projecting pipe fissured on dorsal side.

Measurements: holotype L 26.4, W 3.5, w 2.1, arc 0.8; paratypes L 30.1, W 3.4, w 2.2, arc 0.5; L 27.5, W 3.5, w 2.1, arc 0.6. W/w ratio 1.54-1.67.

ETYMOLOGY. — From New Caledonia.

Source : MNHN, Paris

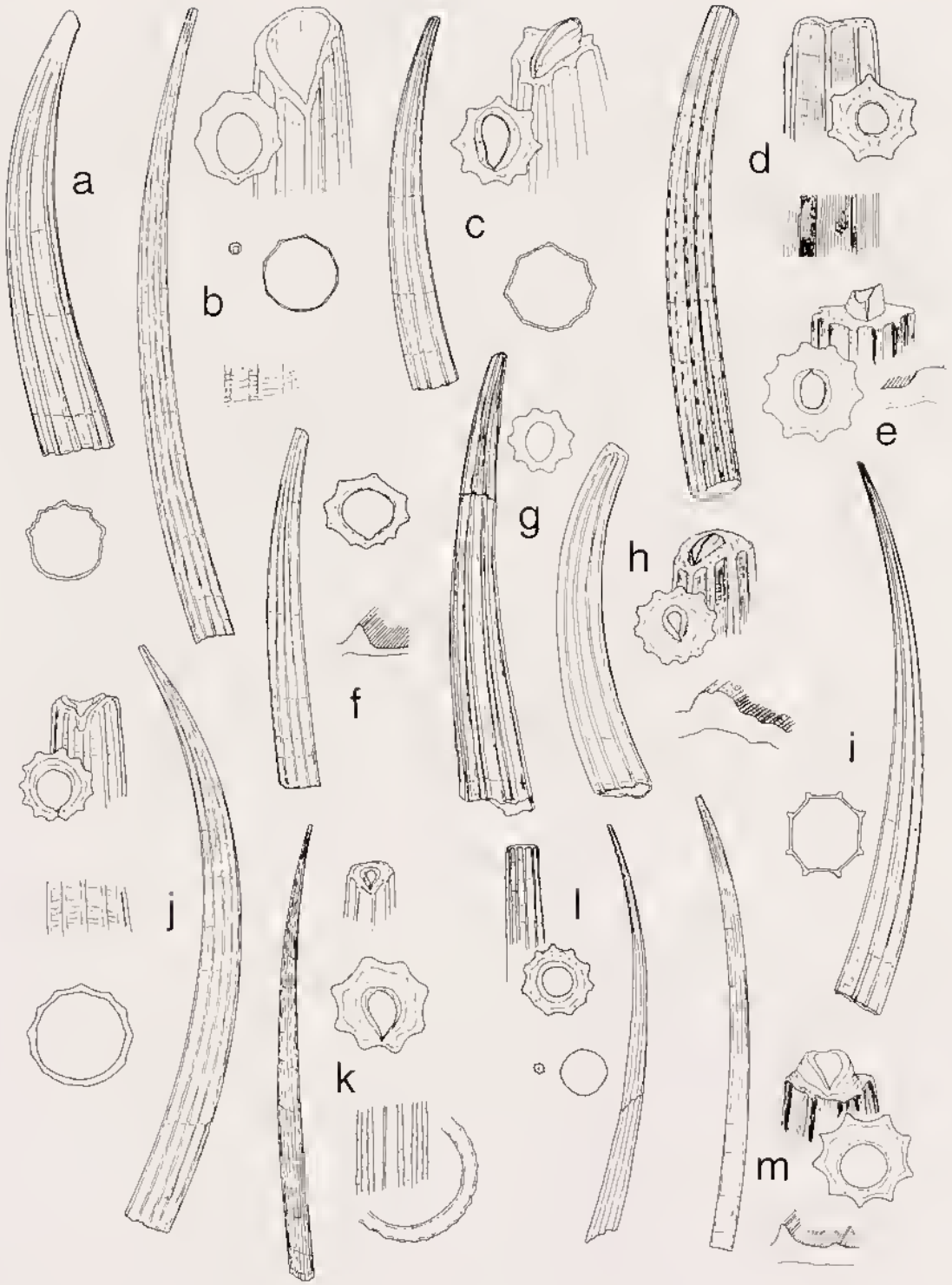


FIG. 16. — **a**, *Dentalium elephantinum*, shell (72 mm) and oral section, India (MNHN). — **b**, *Dentalium aprinum*, shell (75 mm), apex, apical and oral sections, detail of the sculpture, Papua New Guinea (MNHN). — **c**, *Dentalium octangulatum*, shell (40 mm), apex, apical and oral sections. — **d**, *Dentalium variabile*, lectotype (22.5 mm), apex and apical section, detail of the sculpture. — **e**, *Dentalium variabile*, apex and apical section (1.7 mm), detail of rib and sculpture, New Caledonia, LAGON: stn 7. — **f**, *Dentalium strigatum*, shell (18 mm), apical section, detail of the sculpture, MD 32 Réunion: stn CP 172. — **g**, *Dentalium reevei*, lectotype (29.8 mm), shell and apical section. — **h**, *Dentalium reevei*, shell (23 mm), apex, apical section, detail of the sculpture, Tuléar (MNHN). — **i**, *Dentalium javanum*, shell (55 mm) and oral section. Java, Malacca (MNHN). — **j**, *Dentalium bisexangulatum*, shell (72 mm), apex and apical section, detail of the sculpture and oral section, Tuléar (MNHN). — **k**, *Dentalium oryx*, shell (32 mm), apex, apical and oral sections, detail of sculpture, BENTHEDI: stn DR 08. — **l**, *Dentalium leucoryx*, shell (47 mm), apex, apical and oral sections, CORINDON: stn CH 208. — **m**, *Dentalium pluricostatum*, shell (49 mm), apex, apical section and detail of the sculpture, MUSORSTOM 4: stn DW 149.

Source : MNHN, Paris

FIG. 17. — Distribution of *Dentalium caledonicum*.

Dentalium crosnieri sp. nov.

Figs 18, 28 b

TYPE MATERIAL. — Holotype and 7 paratypes, MNHN.

TYPE LOCALITY. — New Caledonia, Loyalty Islands, MUSORSTOM 6, stn DW 428, 20°24′ S, 166°13′ E, 420 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn DW 292, 20°28′ S, 166°48′ E, 465-470 m, 1 dd (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 428, 20°24′ S, 166°13′ E, 420 m, 2 lv, 1 dd (holotype lv and paratypes). — Stn DW 459, 21°01′ S, 167°31′ E, 425 m, 11 dd (2 paratypes). — Stn DW 487, 21°23′ S, 167°46′ E, 500 m, 1 lv, 1 dd (paratypes).

DISTRIBUTION. — New Caledonia and Loyalty Islands, alive in 420-500 m.

FIG. 18. — Distribution of *Dentalium crosnieri*.

Source : MNHN, Paris

DESCRIPTION. — *Shell* to 32 mm long, needle-like, almost straight, solid, white, shiny, with 15-17 primary ribs with rounded edges. Secondary ribs less prominent, but more so towards oral aperture. Intercostal spaces with coarse growth lines only. Oral aperture circular. Apex simple, truncate, circular to slightly flattened dorso-ventrally, lumen circular.

Measurements: holotype L 30.7, W 1.5, w 0.7, arc 0.9; paratypes L 31.5, W 1.6, w 0.9, arc 0.9; L 30.5, W 1.7, w 1.3, arc 0.8; L 23.5, W 1.4, w 0.6, arc 0.8. W/w ratio 1.31-2.34.

REMARKS. — The slight curvature and W/w ratio are the main distinguishing characters of this species. *D. oryx*, its closest relative, differs in apical section and W/w ratio (range 3.6-5.8 in 10 specimens).

ETYMOLOGY. — Named for Alain CROSNIER, ORSTOM, without whom there would have been no MUSORSTOM expeditions. In addition to making possible and participating himself in seven cruises at sea between 1976 and 1992, A. CROSNIER has edited most of the report volumes in the series where the present paper is published.

Dentalium flavum sp. nov.

Figs 19, 28 c, e

TYPE MATERIAL. — Holotype MNHN. Paratypes: 10 MNHN, 1 AMS C201722, 1 NMNZ M268960.

TYPE LOCALITY. — Chesterfield Islands, MUSORSTOM 5, stn DW 301, 22°07′ S, 159°25′ E, 487-610 m.

FIG. 19. — Distribution of *Dentalium flavum*.

MATERIAL EXAMINED. — **Chesterfield Islands.** MUSORSTOM 5: stn DW 301, 22°07′ S, 159°25′ E, 487-610 m, 2 lv (holotype and paratype). — Stn DW 306, 22°08′ S, 159°21′ E, 375-415 m, 1 lv (paratype).
New Caledonia. LAGON: stn 444, 18°15′ S, 162°59′ E, 300-350 m, 1 lv (paratype).
CHALCAL 2: stn DW 72, 24°54′ S, 168°22′ E, 527 m, 2 dd (paratypes).
BIOCAL: stn DW 38, 23°00′ S, 167°15′ E, 360 m, 1 dd (paratype).
SMIB 3: stn DW 01, 24°56′ S, 168°22′ E, 500 m, 1 dd (paratype). — Stn DW 05, 24°55′ S, 168°22′ E, 502-512 m, 1 dd (paratype).

Source : MNHN, Paris

Loyalty Islands. MUSORSTOM 6: stn DW 478, 21°09′ S, 167°54′ E, 400 m, 1 dd (paratype). — Stn DW 479, 21°09′ S, 167°55′ E, 310 m, 3 dd (paratypes: MNHN, AMS, NMNZ).

DISTRIBUTION. — Coral Sea, New Caledonia and Loyalty Islands, alive in 300-610 m.

DESCRIPTION. — *Shell* to 42 mm long, solid, shiny, slightly curved, white with alternating yellow bands. Sculpture consisting of 13-14 rounded primary ribs, secondary ribs appearing below apex, fading by the anterior quarter. Intercostal spaces smooth, except for growth lines and occasional vestigial longitudinal lines. Oral aperture thin, subcircular, slightly depressed on ventral side. Apex truncated, round and wide in cross section, with a projecting pipe fissured at dorsal side.

Measurements: holotype L 36.4, W 3.6, w 1.2, arc 1.5; paratype: L 23.4, W 3.1, w 1.4, arc 1. W/w ratio 2.2-3.0.

ETYMOLOGY. — From the Latin *flavus* (yellow).

Dentalium deforgesi sp. nov.

Figs 20, 28 d, 71 a-b

TYPE MATERIAL. — Holotype and 6 paratypes, MNHN.

TYPE LOCALITY. — New Caledonia, Northern Norfolk Ridge, CHALCAL 2, stn DW 73, 24°40′ S, 168°38′ E, 573 m.

MATERIAL EXAMINED. — **New Caledonia**. CHALCAL 2: stn DW 73, 24°40′ S, 168°38′ E, 573 m, 3 lv (holotype and 2 paratypes).
LAGON: stn 1146, 19°08′ S, 163°31′ E, 185 m, 4 lv (paratypes).

FIG. 20. — Distribution of *Dentalium deforgesi*.

DISTRIBUTION. — New Caledonia, alive in 185-575 m.

DESCRIPTION. — *Shell* to 42 mm long, solid, regularly curved, shiny, cream-white. Sculpture of 11-13 primary ribs, secondary ribs beginning at apex. Ribs decreasing in strength shortly below apex on ventral side, later on dorsal side. Shell smooth for first quarter of length except for growth lines, circular in section, aperture thin, straight. Apex truncate with terminal callus and a deep V-shaped notch on ventral side. Lumen protected by pseudo-pipe fissured on the ventral side; lumen oval, laterally compressed.

Measurements: holotype L 36.3, W 4, w 1.4, arc 2; paratypes L 41.5, W 3.8, w 2.1, arc 1.8; L 37.8, W 3.8, w 1, arc 2; L 35.7, W 2.7, w 1.4, arc 2.2; L 27.1, W 2.8, w 1, arc 1.6. W/w ratio 1.81-3.8.

Source : MNHN, Paris

REMARKS. — This species is similar to *D. obtusum* Qi & Ma, 1989, an intertidal species from China Seas, which differs in having 0-12 primary ribs, and lacking secondary ribs. In *D. deforgesi* the ribs encircle the oral aperture, thus producing an irregular outline.

ETYMOLOGY. — Named for Dr Bertrand RICHER DE FORGES (ORSTOM, Nouméa), organizer of many dredging expeditions in New Caledonia and collector of numerous novelties in every group of marine animals.

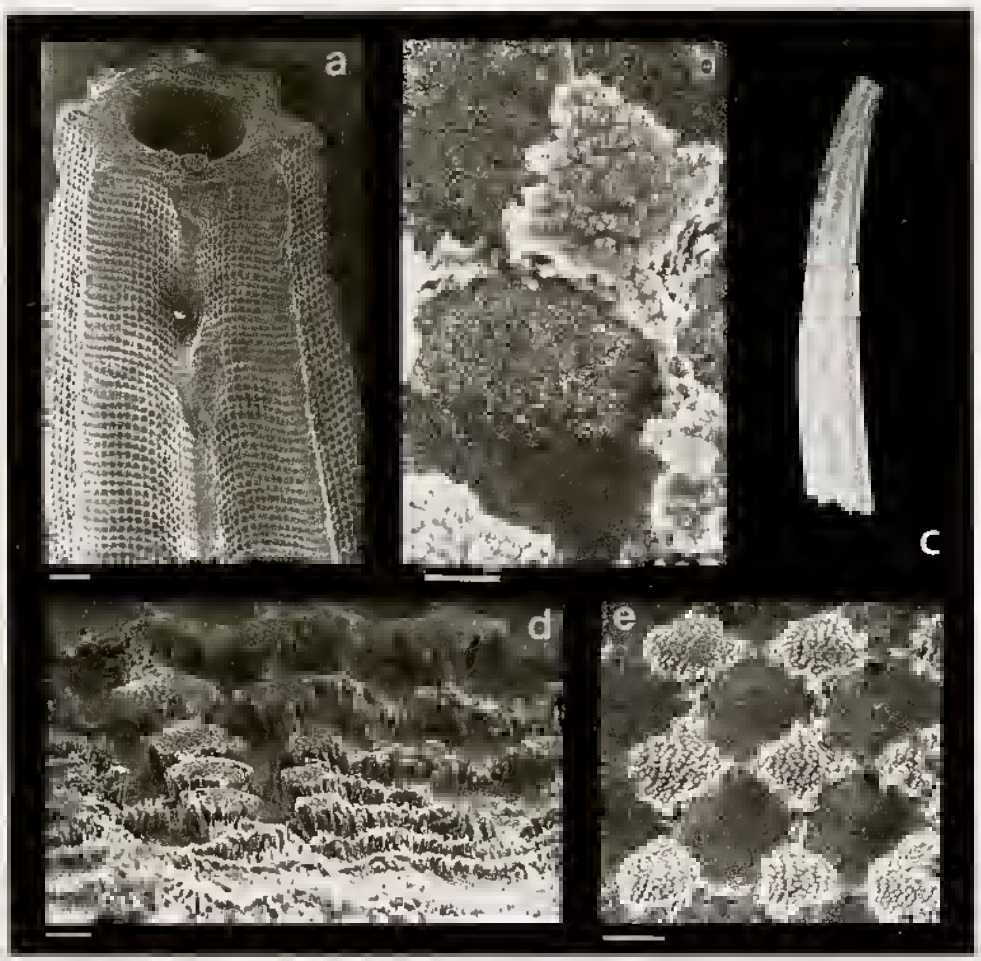


FIG. 21. — *Dentalium tessellatum* sp. nov., holotype. — **a**, apex area. — **c**, lateral view (9.6 mm). — **b**, **d-e**, details of the sculpture. Scale bars: 100 µm (a), 10 µm (b, d, e).

Dentalium tessellatum sp. nov.

Figs 21 a-e, 22

TYPE MATERIAL. — Holotype and 3 paratypes dd, MNHN.

TYPE LOCALITY. — Philippines. MUSORSTOM 3, stn DR 140, 11°43' N, 122°34' E, 93-99 m.

MATERIAL EXAMINED. — Only known from the type material.

Source : MNHN, Paris

FIG. 22. — Distribution of *Dentalium tessellatum*.

DISTRIBUTION. — The Philippines. Only known from the type locality, in 93-99 m, not recorded alive.

DESCRIPTION. — *Shell* to 16 mm long, solid, opaque, cream, slightly curved, with 8 high, rounded primary ribs, lacking secondary ribs. At SEM magnification the entire surface has a mosaic sculpture which appears finely reticulated under an optical microscope. Apex simple or with apical callus, lumen circular.

Measurements: holotype L 9.6, W 1.5, w 0.5, a 0.6; paratypes L 15.1, W 1.6, w 0.6, a 0.6; L 10.1, W 1.6, w 0.5, a 0.4. W/w ratio 2.67-3.2.

REMARKS. — The absence of secondary ribs and the fine sculpture characterize this new species.

ETYMOLOGY. — From the Latin *tessellatus* (mosaic).

Other Indo-Pacific species of *Dentalium* cited in the literature

Dentalium aciculum Gould, 1859: 165. Hong Kong. Holotype USNM 24149.

Dentalium adenense Ludbrook, 1954: 97, fig. 2. Gulf of Aden, *"John Murray"*, stn 28, 12°00′ N, 50°38′ E, 201 m. Holotype BMNH 1952.3.25.124.

Dentalium buccinulum Gould, 1859: 166. Kagoshima, Japan. Holotype USNM 24160.

Dentalium cancellatum Sowerby, 1860: 101, pl. 224 (*Dentalium* 2), fig. 36. China. Type material apparently missing.

Dentalium cheverti Pilsbry & Sharp, 1897: 9. Evans Bay, Cape York, N. Australia, 11 m. ANSP.

Dentalium cookei Pilsbry & Sharp, 1897: 29. Gulf of Suez. ANSP.

Dentalium decemcostatum Brazier, 1877: 55. Katow, New Guinea. 2 syntypes dd AMS A90.

Dentalium duodecemcostatum Brazier, 1877: 56. New Guinea. Holotype AMS A91.

Dentalium laseroni Colman, 1958: 143, fig. 7. Broken Bay, New South Wales. Holotype AMS C62221.

Dentalium lessoni Deshayes, 1825: 357, pl. 2, fig. 13. New Guinea. Lectotype (here designated) 20.3 mm MNHN.

Dentalium letsonae Pilsbry & Sharp, 1897: 4, pl. 1, fig. 13; pl. 5, figs 66-68. Island of Bohol, Philippines. ANSP.

Dentalium nannarense Winckworth, 1927: 167, fig. 4. Nannar Island, Sri Lanka, 6 m. 7 syntypes lv BMNH 1952.3.21.6-12, and NMW (*fide* OLIVER, 1984).

Source : MNHN, Paris

Dentalium obtusum Qi & Ma, 1989: 69. Zhejiang Province, China.
Dentalium regulare Smith, 1903: 393, pl. 15, fig. 2. Port Shepstone, South Africa. 6 syntypes dd BMNH 1903.9.9.24-24a and 1904.7.26.29-32.
Dentalium robustum Brazier, 1877: 56. Katow, New Guinea. Syntype, labelled "lectotype", but designation apparently never published, AMS A95.
Dentalium tignum Colman, 1958: 141, fig. 1. 35 miles East of Sydney, New South Wales, 1463 m. Holotype AMS C24485.
Dentalium townlini Melvill, 1918: 155, pl. 5, fig. 31. Karachi, Pakistan. 5 syntypes dd BMNH 1921.1.28.36-40.
Dentalium woolacottae Colman, 1958: 142, fig. 4. Middle Harbour, Sydney, New South Wales. Holotype AMS C21230.

Genus *Paradentalium* Cotton & Godfrey, 1933

Type species (OD): *D. intercalatum* Gould, 1859.

DIAGNOSIS. — *Shell* medium to large, moderately curved, solid, shiny, polished; translucent, white or yellow. Longitudinally sculptured with 6 primary ribs, the most prominent dorsal, 1 ventral and 4 latero-ventral. Secondary ribs present, variable number. Ribs round, flat or angled in cross section, intercostal spaces generally smooth and straigth on dorsal side and convex on ventral side. Apex simple, truncate, lumen circular, frequently with short terminal pipe. Section hexagonal at apex, subcircular at mouth. Oral aperture generally thin and translucent in fresh specimens.
Radula similar to *Dentalium*.

DISTRIBUTION. — Recent, worldwide, temperate and tropical regions. Sublittoral to bathyal.

Paradentalium pseudosexagonum (Deshayes, 1825)

Figs 23, 28 f

Dentalium pseudosexagonum Deshayes, 1825: 358, pl. 2, figs 14-16.

Other references:

Dentalium pseudo-sexagonum – SOWERBY, 1860: 103, pl. 224 (*Dentalium* 2), fig. 34; 1873: pl. 4, fig. 23. — BRAZIER, 1877: 56. — PILSBRY & SHARP, 1897: 23, pl. 4, figs 47-48. — MELVILL & STANDEN, 1899: 181. — BOISSEVAIN, 1906: 14, pl. 1, fig. 10. — MELVILL, 1909: 120. — LUDBROOK, 1954: 97, fig. 3.
Dentalium (Paradentalium) pseudohexagonum (*sic*) – HABE & KOSUGE, 1964: 1.

TYPE MATERIAL. — 6 syntypes dd, MNHN.

TYPE LOCALITY. — "Unknown" (DESHAYES 1825).

MATERIAL EXAMINED. — The type material.
Indonesia. CORINDON: stn B 210, 00°13′ S, 117°53′ E, 338 m, 1 dd.
"Snellius" II: stn 4.181, 06°21′ S, 120°26′ E, 34 m, 1 dd (RMNH).
Philippines. Philippines, Coll. JOUSSEAUME, 6 dd (MNHN).
China. Hong Kong, Coll. JOUSSEAUME, 1 dd (MNHN).

DISTRIBUTION. — China Sea, the Philippines to Indonesia, Northern Australia, Seychelles and the Gulf of Aden. Probably a shallow-water species, shells down to 499 m (LUDBROOK, 1954).

Source : MNHN, Paris

FIG. 23. — Distribution of *Paradentalium pseudosexagonum*.

Paradentalium intercalatum (Gould, 1859)
Figs 24, 28 g

Dentalium intercalatum Gould, 1859: 106.

Other references:
Dentalium intercalatum — SOWERBY, 1873: pl. 7, fig. 45. — BOISSEVAIN, 1906: 22, pl. 1, fig. 9. — PILSBRY & SHARP, 1897: 23, pl. 11, figs 88-89. — HABE, 1977: 330. — JOHNSON, 1964: 93.
Dentalium (Paradentalium) intercalatum — HABE & KOSUGE, 1964: 1.

TYPE MATERIAL. — Holotype USNM 24183.

TYPE LOCALITY. — China Seas.

MATERIAL EXAMINED. — The type material.
Philippines. MUSORSTOM 3: stn DR 137, 12°03′ N, 122°06′ E, 56 m, 1 dd.

DISTRIBUTION. — China Sea, now extended to the Philippines; no living records.

FIG. 24. — Distribution of *Paradentalium intercalatum*.

Source : MNHN, Paris

Paradentalium hexagonum (Gould, 1859)

Figs 25, 28 h

Dentalium hexagonum Gould, 1859: 166.

Synonyms:

Dentalium sexcostatum Sowerby, 1860: 103, pl. 223 (*Dentalium* 1), fig. 44.
Dentalium minus Boissevain, 1906: 14, pl. 6, fig. 3 (**Syn. nov.**).

Other references:

Dentalium hexagonum – Sowerby, 1860: 103, pl. 223 (*Dentalium* 1), fig. 10; 1873: pl. 2, fig. 6. — Clessin, 1896: 14, pl. 24, fig. 2. — Pilsbry & Sharp, 1897: 18, pl. 2, figs 20-21, 23-24. — Boissevain, 1906: 12, pl. 1, fig. 14, pl. 6, fig. 1. — Hirase, 1931: 133, pl. 3, fig. 2. — Johnson, 1964: 88, pl. 22, fig. 4.
Dentalium hexagonum var. *sexcostatum* – Pilsbry & Sharp, 1897: 19, pl. 2, figs 27-28. — Boissevain, 1906: 13, pl. 6, fig. 2.
Paradentalium hexagonum sexcostatum – Chistikov, 1979b: 109.
Dentalium (*Paradentalium*) *hexagonum* – Kira, 1955: 80, pl. 40, fig. 7.
Dentalium sexcostatum – Smith, 1875: 25.
Paradentalium minus – Habe & Kosuge, 1964: 2. – Chistikov, 1979b: 109.

Type material. — *D. hexagonum*: holotype USNM 2053. — *D. sexcostatum*: not located. — *D. minus*: lectotype (here designated) ZMA 3.06.008, paralectotypes ZMA 3.06.009.

Type locality. — *D. hexagonum*: Hong Kong, China. — *D. sexcostatum*: China. — *D. minus*: Indonesia, Java Sea, *"Siboga"*, stn 319, 06°17′ S, 114°37′ E, 82 m.

Material examined. — The type material of *D. hexagonum* and *D. minus*.
Indonesia. CORINDON: stn B 202, 01°10′ S, 117°06′ E, 21 m, 1 lv. — Stn CH 203, 01°09′ S, 117°08′ E, 25 m, 1 dd. — Stn CH 204, 01°09′ S, 117°19′ E, 49 m, 2 dd.

Fig. 25. — Distribution of *Paradentalium hexagonum*.

Distribution. — China Sea to Indonesia; alive in 15-29 m (Chistikov, 1979b and present paper).

Remarks. — Nomura (1938) synonymized *P. hexagonum* with *Dentalium octangulatum* based on rib count in 1500 specimens of *D. octangulatum*, of which 33 shells were found to have 6 ribs. The

Source : MNHN, Paris

material identifed by us as *P. hexagonum* presents 6 ribs, no secondary rib, and intercostal spaces are smooth or with traces of longitudinal threads. *D. octangulatum* has secondary ribs that, although they never reach the size of the primary ones, obscure the octangular section at the mouth. Variation in the number of ribs is observed in several species and I consider the presence of six ribs in occasional specimens of *D. octangulatum* insufficient to support the synonymy established by NOMURA. In specimens of *P. hexagonum* I have studied, characters were constant.

Paradentalium natalensis (Barnard, 1963)

Figs 26, 28 i

Dentalium natalensis Barnard, 1963b: 350, fig. 30 e; 1974: 742.

TYPE MATERIAL. — 49 syntypes (*fide* BARNARD) SAM A9364, 6 syntypes dd BMNH 1964.2.57.

TYPE LOCALITY. — South Africa, off Cape Natal, Durban, 85 fms [156 m].

MATERIAL EXAMINED. — The type material in BMNH.
West Indian Ocean. Madagascar, Nosy Bé Island, 50 m, Plante coll., 2 lv, 4 dd (BMNH).
South Africa. *"Meiring Naudé"*: stn SM 94, 28°16′ S, 32°29′ E, 670 m, 1 dd (SAM).

FIG. 26. — Distribution of *Paradentalium natalensis*.

DISTRIBUTION. — South Africa, from off East London to Madagascar. Alive in 50 m, shells from 70 to 670 m.

Paradentalium rudoi sp. nov.

Figs 27, 28 j, l

TYPE MATERIAL. — Holotype MNHN. Paratypes: 9 MNHN, 1 NMP.

TYPE LOCALITY. — Western Indian Ocean. NE Madagascar, 12°39′ S, 48°17′ E, 240 m.

Source : MNHN, Paris

MATERIAL EXAMINED. — **West Indian Ocean**. NW Madagascar, *"Vauban"*: 12°39′ S, 48°17′ E, 240 m, A. Crosnier coll. 1974, 13 dd (holotype and 6 paratypes MNHN, 1 paratype NMP). BENTHEDI: stn DS 72, 12°31′ S, 45°02′ E, 300-350 m, 2 lv, 1 dd (paratypes).

FIG. 27. — Distribution of *Paradentalium rudoi*.

DISTRIBUTION. — Off North Madagascar, alive in 300-350 m.

DESCRIPTION. — *Shell* to 60 mm long, solid, polished, yellow, regularly curved. Six primary angle-edged ribs distributed one on the dorsal side, one on each side and 3 on the ventral side. Secondary ribs appear at the posterior third of the shell, fading at the aperture. Intercostal spaces with fine longitudinal and transverse lines, which give the apical area a reticulate appearance. Apex simple, lumen slightly irregularly compressed dorsoventrally.

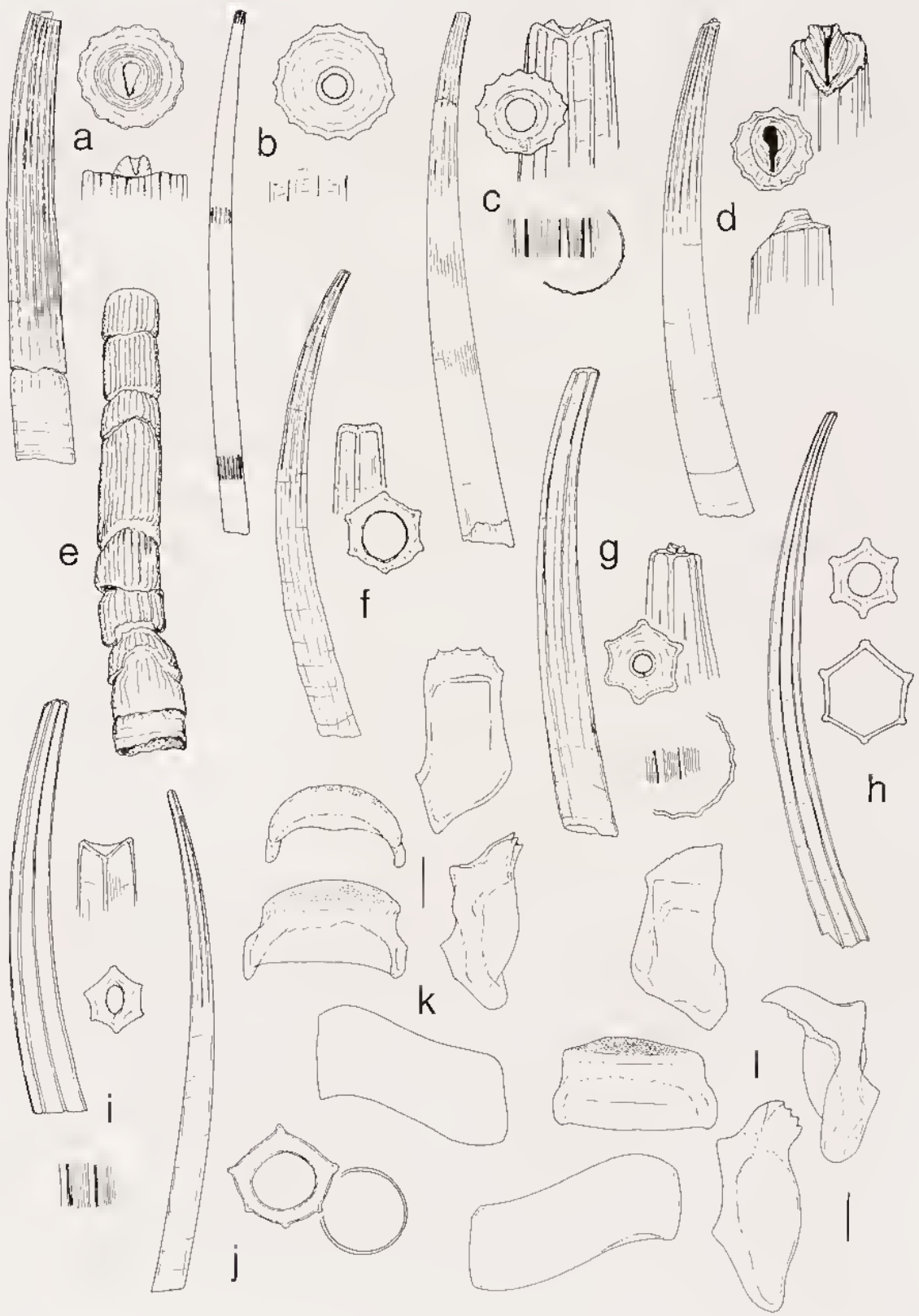
Measurements: holotype L 52.8, W 3.8, w 1.2, arc 2.8; paratypes L 60.2, W 3.9, w 1.5, arc 4.2; L 51, W 3.5, w 1, arc 3.5; L 47.5, W 3.4, w 1, arc 2.1; L 45.2, W 3, w 0.9, arc 2; L 50.9, W 3.5, w 1.1, arc 2.1. W/w ratio 2.6-3.5.

REMARKS. — *P. pseudosexagonum* is a related species from which *P. rudoi* differs in having sculptured intercostal spaces, a longer and more slender shell with differently placed ribs and different brightness and color.

ETYMOLOGY. — Named after Rudo VON COSEL, MNHN, who has contributed to our knowledge of the Madagascar fauna by collecting remarkable and spectacular mollusc species during a survey of shrimp resources conducted in 1989.

FIG. 28. — **a**, *Dentalium caledonicum* sp. nov., holotype, shell (26.4 mm), apex and apical section. — **b**, *Dentalium crosnieri* sp. nov., holotype, shell (30.7 mm), apical section and detail of the sculpture. — **c**, *Dentalium flavum* sp. nov., holotype, shell (36.4 mm), apex, apical and oral sections, detail of the sculpture. — **d**, *Dentalium deforgesi* sp. nov., holotype, shell (36.3 mm), apex and apical section. — **e**, *Dentalium flavum* sp. nov., extremely damaged and repaired shell (33 mm). — **f**, *Paradentalium pseudosexagonum*, shell (38 mm), apex and apical section, CORINDON: stn B 210. — **g**, *Paradentalium intercalatum*, shell (20 mm), apex, apical and oral sections, detail of the sculpture, MUSORSTOM 3: stn DR 137. — **h**, *Paradentalium hexagonum*, shell (35 mm), apical and oral sections, CORINDON: stn CH 203. — **i**, *Paradentalium natalensis*, shell (22 mm), apex and apical section, detail of the sculpture. — **j**. *Paradentalium rudoi* sp. nov., holotype, shell (52.8 mm), apical and oral sections. — **k**, *Dentalium* type radula (*D. pluricostatum*). — **l**, *Paradentalium* type radula (*P. rudoi* sp. nov.). Scale lines: 100 µm.

Source : MNHN, Paris



Source : MNHN, Paris

Other Indo-Pacific species of *Paradentalium* cited in the literature

Paradentalium angustistriatum Chistikov, 1979b: 110, fig. 2. Tonking Bay, Viet Nam, 47 m. ZIN.
Paradentalium gradile Chistikov, 1979b: 109, fig. 1. Tonking Bay, Viet Nam, 60 m. ZIN.
Paradentalium katowense (Brazier, 1877): 56. Katow, New Guinea, 15 m. Holotype AMS A92.
Paradentalium pistis (Winckworth, 1940b): 43, fig. 6. Madras, India. Holotype BMNH 1940.7.227.

Genus *TESSERACME* Pilsbry & Sharp, 1897

Type species (SD by WOODRING, 1925): *Dentalium quadrapicale* Sowerby, 1860.

DIAGNOSIS. — *Shell* medium to large, moderately curved, solid, generally polished; white, cream to orange-yellow at apical area. Longitudinally sculptured with 4 primary ribs, prominent at the apex, simple or bifurcated, one ventral, one dorsal and two lateral. Secondary ribs present, variable in number. Intercostal spaces straight or concave, smooth or with longitudinal striae. Apex simple, truncate, lumen circular; frequently with short terminal pipe. Transverse section quadrangular at apex, subquadrangular to subcircular at mouth; oral aperture generally thin and translucent in fresh specimens. *Radula* similar to *Dentalium*.

DISTRIBUTION. — Eocene-Recent. Pacific and Indian Oceans, absent in the Atlantic Ocean; sublittoral to shelf in temperate and warm waters.

Tesseracme quadrapicalis (Hanley, 1860)

Figs 29, 33 a

Dentalium quadrapicale Hanley *in* Sowerby, 1860: 103, pl. 225 (*Dentalium* 3), fig. 61.

Synonyms:

Dentalium conspicuum Melvill, 1897: 21, pl. 7, fig. 28 (**Syn. nov.**).
Dentalium dipsycha Pilsbry & Sharp, 1897: 33, pl. 4, figs 57-60 (**Syn. nov.**).

Other references:

Dentalium quadrapicale — SOWERBY, 1873: pl. 7, fig. 46. — SMITH, 1896: 371. — PILSBRY & SHARP, 1897: 34, pl. 4, fig. 50. BOISSEVAIN, 1906: 42, pl. 1, fig. 13. — WINCKWORTH, 1940b: 25. — AHMED, 1975: 29, fig. 33.
Tesseracme quadrapicale — HABE & KOSUGE, 1964: 5.
Dentalium (*Tesseracme*) *quadrapicale* — PLATE, 1908a: 350, pl. 30, fig. 53. — LUDBROOK, 1954: 102, fig. 5.
Dentalium quadripicale (*sic*) — CLESSIN, 1896: 13, pl. 3, fig. 6.
Dentalium conspicuum — PILSBRY & SHARP, 1898: 248, pl. 33, fig. 60. — BOISSEVAIN, 1906: 42, pl. 2, fig. 26. DINAMANI, 1964: 1.
Dentalium dipsycha — BOISSEVAIN, 1906: 42, pl. 2, figs 24-25.

TYPE MATERIAL. — *D. quadrapicale*: holotype BMNH 1907.10.28.147, paratypes BMNH 1907.10.28.148-149. — *D. conspicuum*: 2 syntypes dd BMHN 1897.30.80-81. — *D. dipsycha*: syntype ANSP.

TYPE LOCALITY. — *D. quadrapicale*: Cochin, Malabar, India. — *D. conspicuum*: Karachi. — *D. dipsycha*: unknown.

MATERIAL EXAMINED. — The type material.
West Indian Ocean. Malabar, 28 dd. — "Côtes de Malabar", 60 dd. — Karachi, Coll. JOUSSEAUME, 1 lv. — Karachi, Coll. DENIS, 2 dd (all MNHN).

Source : MNHN, Paris

FIG. 29. — Distribution of *Tesseracme quadrapicalis*.

DISTRIBUTION. — Malaya (HABE & KOSUGE, 1964), Indonesia (BOISSEVAIN, 1906), S of India in 742 m (SMITH, 1896), Gulf of Oman (LUDBROOK, 1954). Living depth range unknown, apparently a shallow water species, shells cited from 9 m to 742 m .

REMARKS. — The syntypes of *Dentalium conspicuum* are gerontic specimens with the apex wide by reabsorption, 8-ribbed in section but the 4 primary ribs clearly noticed indicate its generic position. *Tesseracme* are variable in shell shape, curvature, width of the apex and starting point of the secondary ribs. I have observed this in specimens of *T. quadrapicalis* and specially in a large number of specimens of *T. tetrapleura*, and which allows me to ascertain the present synonymy.

Tesseracme dispar (Sowerby, 1860)

Figs 30, 33 b

Dentalium dispar Sowerby, 1860: 103, pl. 224 (*Dentalium* 2), fig. 37.

Other references:

Dentalium dispar — SOWERBY, 1873: pl. 4, fig. 25. — BRAZIER, 1877: 58. — CLESSIN:, 1896 11, pl. 2, fig. 4. — PILSBRY & SHARP, 1897: 32, pl. 4, figs 52-56. — BOISSEVAIN, 1906: 39, pl. 2, figs 22-23.
Tesseracme dispar — HABE & KOSUGE, 1964: 5.

TYPE MATERIAL. — Four specimens from the Island of Samar, 4 fms [7 m] in BMNH, could belong to the type series, but this is far from certain.

TYPE LOCALITY. — Singapore and Samar, the Philippines.

MATERIAL EXAMINED. — **Indonesia**. CORINDON: stn B 253, 00°54′ S, 119°30′ E, 17 m, 2 dd. **China**. Hong Kong, Coll. JOUSSEAUME, 1 dd (MNHN).

DISTRIBUTION. — Philippines and China to Indonesia and North Australia, 0-54 m (HABE & KOSUGE, 1964).

Source : MNHN, Paris

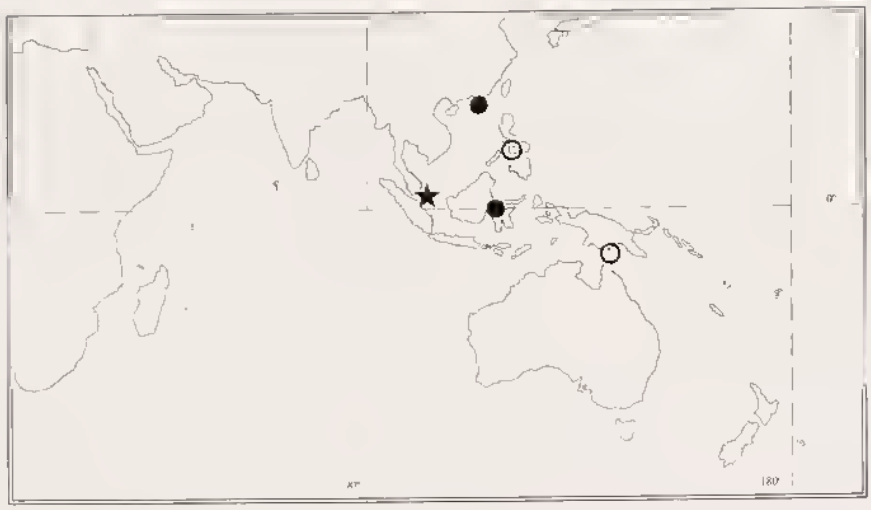


FIG. 30. — Distribution of *Tesseracme dispar*.

Tesseracme tetrapleura (Boissevain, 1906)

Figs 31, 33 c-d

Dentalium tetrapleurum Boissevain, 1906: 41, pl. 6, fig. 37.

Other reference:
Dentalium tetrapleurum — HABE & KOSUGE, 1964: 5 (as a synonym of *Tesseracme quadrapicale*).

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.49, paralectotype ZMA 3.06.50.

TYPE LOCALITY. — *"Siboga"*, stn 4, 07°42′ S, 114°13′ E, 9 m, anchorage off Djankar, Java.

MATERIAL EXAMINED. — The type material.
New Caledonia. LAGON: stn 41, 22°19′ S, 166°16′ E, 28-46 m, 1 dd. — Stn 58, 22°09′ S, 166°13′ E, 22 m, 1 dd. — Stn 63, 22°26′ S, 166°26′ E, 20 m, 1 lv. — Stn 65, 22°29′ S, 166°26′ E, 24 m, 1 lv. — Stn 80, 22°31′ S, 166°28′ E, 33 m, 5 lv, 12 dd. — Stn 83, 22°32′ S, 166°30′ E, 22 m, 2 lv, 1 dd. — Stn 170, 22°09′ S, 166°07′ E, 22 m, 2 dd. — Stn 171, 22°11′ S, 166°06′ E, 32 m, 1 dd. — Stn 192, 22°01′ S, 166°00′ E, 18 m, 2 lv. — Stn 201, 22°00′ S, 165°59′ E, 17 m, 1 lv. — Stn 202, 21°59′ S, 165°57′ E, 13 m, 1 lv. — Stn 211, 21°55′ S, 165°52′ E, 12 m, 1 dd. — Stn 214, 21°55′ S, 165°48′ E, 12 m, 1 lv, 1 dd. — Stn 216, 21°53′ S, 165°49′ E, 14 m, 1 dd. — Stn 226, 22°38′ S, 166°39′ E, 28 m, 1 lv, 1 dd. — Stn 239, 22°24′ S, 166°58′ E, 43 m, 2 dd. — Stn 244, 22°25′ S, 167°00′ E, 37 m, 1 lv, 1 dd. — Stn 290, 22°16′ S, 166°32′ E, 11 m, 1 dd. — Stn 311, 22°44′ S, 166°47′ E, 36 m, 2 lv, 2 dd. — Stn 348, 22°42′ S, 166°55′ E, 45 m, 1 dd. — Stn 353, 22°34′ S, 167°01′ E, 70 m, 1 dd. — Stn 360, 22°35′ S, 167°03′ E, 60 m, 1 lv, 1 dd. — Stn 470, 18°28′ S, 163°09′ E, 41 m, 1 dd. — Stn 473, 18°24′ S, 163°03′ E, 50 m, 2 dd. — Stn 517, 19°09′ S, 163°35′ E, 42 m, 2 dd. — Stn 541, 19°06′ S, 163°13′ E, 45 m, 2 lv, 3 dd. — Stn 601, 22°18′ S, 167°03′ E, 47-48 m, 1 lv, 2 dd. — Stn 602, 22°16′ S, 167°03′ E, 43-48 m, 4 dd. — Stn 607, 22°12′ S, 167°03′ E, 48-54 m, 2 lv. — Stn 619, 22°03′ S, 166°54′ E, 27-42 m, 1 dd. — Stn 632, 21°57′ S, 166°50′ E, 44-45 m, 2 lv, 4 dd. — Stn 633, 21°56′ S, 166°48′ E, 50 m, 1 dd. — Stn 667, 21°42′ S, 166°28′ E, 33-37 m, 2 lv, 2 dd. — Stn 676, 21°35′ S, 166°23′ E, 41 m, 1 dd. — Stn 682, 21°34′ S, 166°19′ E, 36-37 m, 2 lv. — Stn 687, 21°33′ S, 166°17′ E, 37-40 m, 1 lv. — Stn 688, 21°31′ S, 166°15′ E, 36-40 m, 1 lv. — Stn 696, 21°29′ S, 166°12′ E, 41-57 m, 1 lv, 4 dd. — Stn 697, 21°28′ S, 166°10′ E, 35-36 m, 1 dd. — Stn 701, 21°28′ S, 166°07′ E, 36-39 m, 1 lv, 1 dd. — Stn 702, 21°27′ S, 166°08′ E, 37 m, 1 lv. — Stn 703, 21°25′ S, 166°07′ E, 38-40 m, 5 lv, 1 dd. — Stn 704, 21°27′ S, 166°06′ E, 46-58 m, 1 lv. — Stn 707, 21°25′ S, 166°04′ E, 24-38 m, 1 lv, 1 dd. —

Source : MNHN, Paris

Stn 716, 21°22′ S, 165°59′ E, 30 m, 1 lv. — Stn 726, 21°20′ S, 165°55′ E, 50-51 m, 1 dd. — Stn 729, 21°19′ S, 165°54′ E, 42-45 m, 4 lv, 4 dd. — Stn 730, 21°07′ S, 165°55′ E, 40-43 m, 1 lv, 3 dd. — Stn 747, 21°15′ S, 165°51′ E, 31-34 m, 1 lv. — Stn 749, 21°18′ S, 165°18′ E, 49 m, 1 dd. — Stn 754, 21°13′ S, 165°49′ E, 36 m, 1 lv, 1 dd. — Stn 762, 21°12′ S, 165°46′ E, 43 m, 1 dd. — Stn 772, 21°08′ S, 165°41′ E, 30 m, 1 dd. — Stn 781, 21°05′ S, 165°38′ E, 36 m, 3 dd. — Stn 787, 21°04′ S, 165°36′ E, 39 m, 1 lv. — Stn 801, 21°02′ S, 165°29′ E, 29 m, 2 lv, 1 dd. — Stn 822, 20°51′ S, 165°21′ E, 33 m, 1 dd. — Stn 856, 20°37′ S, 165°11′ E, 30 m, 2 lv. — Stn 865, 20°39′ S, 165°04′ E, 24 m, 1 lv. — Stn 866, 20°38′ S, 165°03′ E, 26 m, 1 dd. — Stn 867, 20°39′ S, 165°01′ E, 25 m, 1 dd. — Stn 898, 20°14′ S, 167°27′ E, 22 m, 5 dd. — Stn 913, 20°58′ S, 164°32′ E, 10-13 m, 1 dd. — Stn 916, 20°56′ S, 164°28′ E, 13 m, 1 lv, 2 dd. — Stn 931, 20°45′ S, 164°17′ E, 28-29 m, 1 lv, 1 dd. — Stn 932, 20°46′ S, 164°17′ E, 23 m, 3 lv, 1 dd. — Stn 972, 20°25′ S, 163°58′ E, 27 m, 1 dd. — Stn 995, 20°15′ S, 163°55′ E, 35-36 m, 1 lv, 2 dd. — Stn 1007, 20°12′ S, 163°52′ E, 23-24 m, 1 lv. — Stn 1015, 20°10′ S, 163°52′ E, 25 m, 1 lv. — Stn 1025, 20°07′ S, 163°49′ E, 25-28 m, 9 lv, 9 dd. — Stn 1063, 20°03′ S, 163°47′ E, 31 m, 1 dd. — Stn 1126, 19°33′ S, 163°46′ E, 41 m, 1 dd. — Stn 1168, 19°16′ S, 163°09′ E, 50 m, 2 dd. — Stn 1182, 19°27′ S, 163°16′ E, 48 m, 1 lv. — Stn 1205, 19°42′ S, 163°26′ E, 38 m, 1 lv.

Loyalty Islands. MUSORSTOM 6: stn DW 435, 20°21′ S, 166°08′ E, 32 m, 1 dd.

Indonesia. CORINDON: stn B 251, 00°54′ S, 119°30′ E, 95 m, 1 dd.

"Snellius" II: stn 4.025, 05°57′ S, 123°49′ E, 250-300 m, 2 dd (RMNH).

FIG. 31. — Distribution of *Tesseracme tetrapleura*.

DISTRIBUTION. — Indonesia, now extended to New Caledonia. Alive in 10-70 m (present paper).

Genus *EUDENTALIUM* Cotton & Godfrey, 1933

Type species (OD): *Dentalium quadricostatum* Brazier, 1877.

DIAGNOSIS. — *Shell* small to medium with four ribs, intercostal spaces smooth and straight. Apical callus prominent, lumen circular, pipe present. Ribs simple, high, with rounded section, irregular due to growth lines.

Radula unknown, assumed to be similar to *Tesseracme*.

DISTRIBUTION. — Recent. Eastern Australian waters, New Guinea, sublittoral-shelf.

Source : MNHN, Paris

Eudentalium quadricostatum (Brazier, 1877)

Figs 32, 33 e

Dentalium quadricostatum Brazier, 1877: 58.

Other references:
Dentalium quadricostatum – Pilsbry & Sharp, 1897: 33. — Cotton & Godfrey, 1933: 140.

Type material. — 5 syntypes dd, ams A94.

Type locality. — Northeastern Australia, Princess Charlotte Bay, 13 fms [24 m].

Material examined. — The syntypes.
Northeastern Australia. Off Pioneer Bay, Orpheus Island, 26 m, Reid coll., 1 dd (bmnh).

Fig. 32. — Distribution of *Eudentalium quadricostatum*.

Distribution. — East Australia, Papua New Guinea (Brazier, 1877), shells in 15-24 m.

Genus *Antalis* H. & A. Adams, 1854

Type species (SD by Pilsbry & Sharp, 1897): *Dentalium entalis* Linné, 1758. Recent, Europe.

Diagnosis. — *Shell* medium to large, moderately to well curved; general aspect variable, solid to thin and fragile, generally polished; white, cream, and/or orange-yellow at the apex. Longitudinally sculptured, primary ribs variable in number, and strength; secondary ribs present, also variable in number and can equal primary ribs in size at the oral area. Ribs generally round in section, occasionally flat or angled; smooth or sculptured. Intercostal spaces concave or convex, smooth or sculptured by longitudinal or transverse striae. Apex simple, truncate, with a V-shaped notch or irregular slit on ventral side; lumen circular, commonly with short terminal pipe. Section "polygonal" at apex, circular, subcircular dorsoventrally compressed, or subpolygonal at mouth; generally thin and translucent in fresh specimens.

Source : MNHN, Paris

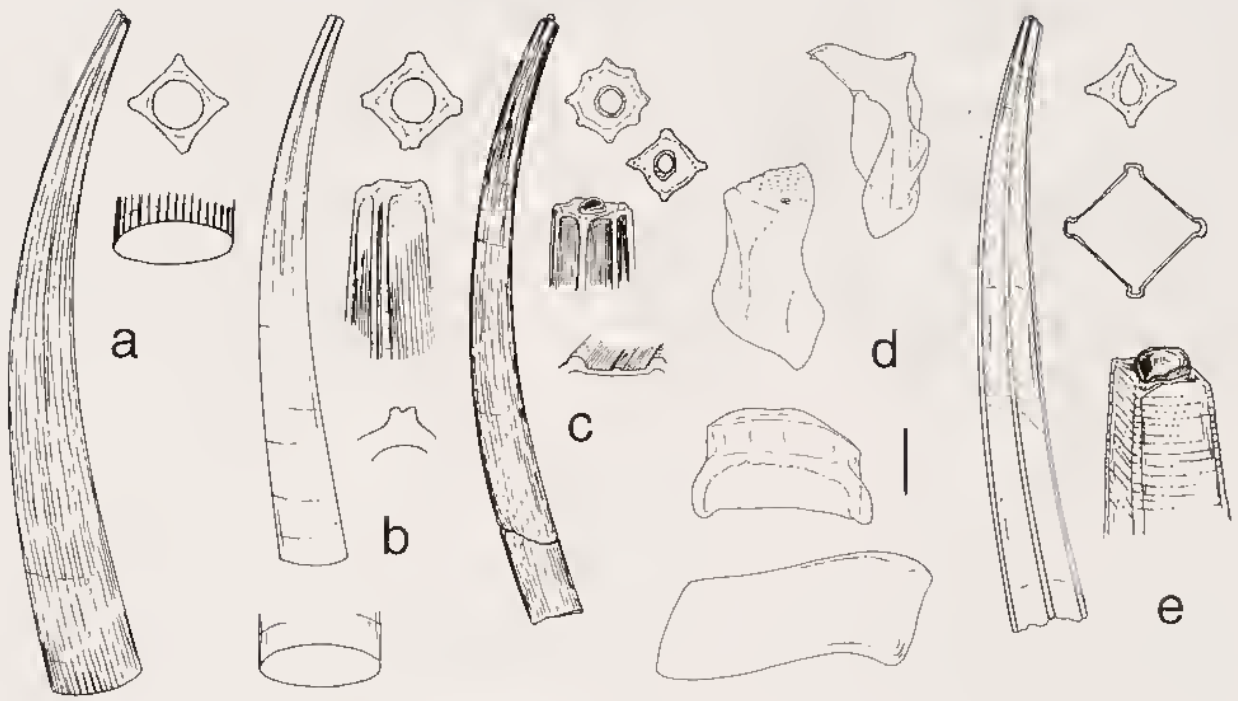


FIG. 33. — **a**, *Tesseracme quadrapicalis*, shell (42 mm), apical section, detail of the sculpture at the mouth, Karachi, MNHN. — **b**, *Tesseracme dispar*, shell (30 mm), apex, apical section, section of a rib, sculpture at the mouth, CORINDON; stn B 253. — **c**, *Tesseracme tetrapleura*, shell (35 mm), apical sections, apex, detail of the sculpture, New Caledonia LAGON: stn 83. — **d**, *Tesseracme* type radula (*T. tetrapleura*). Scale line: 100 µm. — **e**, *Eudentalium quadricostatum*, shell (22 mm), apex, apical and oral sections, Orpheus Isl. (BMNH).

Radula rachidian similar to *Dentalium*, anterior margin with granulae; laterals well armed, head area granulose.

DISTRIBUTION. — Triassic-Recent, worldwide. Sublittoral to abyssal.

Antalis longitrorsum (Reeve, 1842)

Figs 34, 45 a

Dentalium longitrorsum Reeve, 1842a: 197; 1842b: 6, pl. 130, fig. 6.

Synonym:

Dentalium lamarcki Chenu, 1843: 2, pl. 6, figs 15-15a.

Other references:

Dentalium longitrorsum – REEVE, 1842b: 6, pl. 130, fig. 6. — SOWERBY, 1860: 98, pl. 225 (*Dentalium* 3), figs 59-60; 1873: pl. 2, figs 9a-b. — BRAZIER, 1877: 59. — WATSON, 1879: 515; 1886: 9. — COOKE, 1885: 273. — MELVILLE & ABERCROMBIE, 1893: 41. — CLESSIN, 1896: 23, pl. 1, fig. 2. — PILSBRY & SHARP, 1897: 111, pl. 20, figs 35-36. — SMITH, 1903: 393; 1906b: 58. — BOISSEVAIN, 1906: 52, pl. 2, figs 33-33a. — LAMY, 1938: 88. — MOAZZO, 1939: 222. — DAWIDOFF, 1952: 114. — KURODA & HABE, 1952: 36. — DHARMA, 1992: 78, fig. 14.
Dentalium (Laevidentalium) longitrorsum – LUDBROOK, 1954: 104.
Laevidentalium longitrorsum – MATSUKUMA et al., 1991: 183. — HABE & KOSUGE, 1964: 7.
Dentalium longirostrum – PAETEL, 1873: 79. — MASTALLER, 1978: 136.
Antalis longitrorsum – KILBURN & RIPPEY, 1982: 148, pl. 34, fig. 5.
Laevidentalium longitorsum (*sic*) – HIGO & GOTO, 1993: 687.

Source : MNHN, Paris

TYPE MATERIAL. — *D. longitrorsum*: holotype BMNH 1887.3.4.21. — *D. lamarcki*: probably in MHNG.

TYPE LOCALITY. — *D. longitrorsum*: Zanzibar. — *D. lamarcki*: China Seas.

MATERIAL EXAMINED. — The holotype of *D. longitrorsum*.
West Indian Ocean. Madagascar, Tulèar. Harbour, 0-3 m, 1 lv, 86 dd. — N harbour, 2-4 m, 5 dd. — Pointe Anosy, 0.5-2 m, 1 dd. — N of jetty, tidal flat, fine sand at low tide, 28 dd. — NW of jetty, tidal flat, fine sand at low tide, 33 dd. — S of jetty, low tide, 16 dd (all R. von Cosel coll., MNHN). — Lagoon, 0-13 m, 6 dd. — Grand Récif, shore, 15 dd. — Foly, 7 m, 1 lv, 2 dd. — Nosy Bé Island, NW Madagascar, coll. Plante, 5 dd (all BMNH).
"*Meiring Naudé*": stn SM 114, 29°11′ S, 31°43′ E, 40 m, 1 dd (SAM).

FIG. 34. — Distribution of *Antalis longitrorsum*.

DISTRIBUTION. — China, the Philippines, New Guinea, Northern Australia, India, Red Sea, Zanzibar and Natal, 65-68 m (LUDBROOK, 1954); Madagascar, alive in 0-3 m (present paper).

Antalis porcatum (Gould, 1859)

Figs 35, 45 b

Dentalium porcatum Gould, 1859: 166.

Other references:

Dentalium porcatum — SOWERBY, 1873: pl. 7, fig. 47. — CLESSIN, 1896: 20, pl. 6, fig. 3. — PILSBRY & SHARP, 1897: 15, pl. 6, fig. 80. — BOISSEVAIN, 1906: 15, pl. 1, fig. 15. — HABE & KOSUGE, 1964: 2. — JOHNSON, 1964: 130, pl. 18, fig. 5.

TYPE MATERIAL. — Holotype MCZ 169304 (*fide* JOHNSON, 1964), paratype USNM 24142.

TYPE LOCALITY. — Hong Kong Harbour, China.

MATERIAL EXAMINED. — The paratype.
West Indian Ocean. MD 32 Réunion: stn DC 86, 20°59′ S, 55°15′ E, 75-90 m, 2 lv, 8 dd.

Source : MNHN, Paris

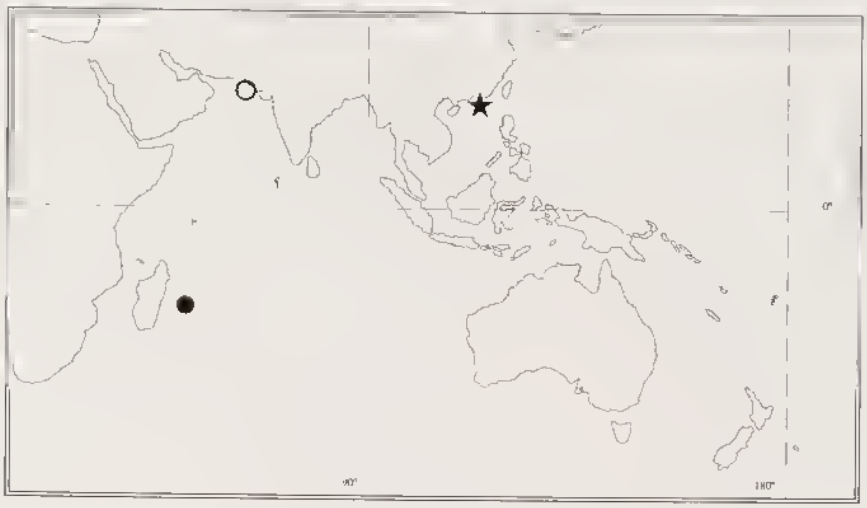


FIG. 35. — Distribution of *Antalis porcatum*.

DISTRIBUTION. — China, Karachi (BOISSEVAIN, 1906). Now extended to Réunion Island, alive in 75-90 m.

Antalis weinkauffi (Dunker, 1877)

Figs 36, 45 c

Dentalium weinkauffi Dunker, 1877: 68; 1882: 153, pl. 5, fig. 1.

Synonym:

Antalis septentrionalis Kuroda & Habe *in* Habe, 1963: 262, pl. 38, fig. 34, textfigs 15-17 (**Syn. nov.**).

Other references:

Dentalium weinkauffi – PILSBRY, 1895: 116. — PILSBRY & SHARP, 1897: 40, pl. 2, fig. 26. — HIRASE, 1931: 135, pl. 3, fig. 4. — HABE, 1957: 128, fig. 7. — HABE *et al.*, 1986: 24.
Dentalium (Dentale) weinkauffi – KIRA, 1955: 80, pl. 40, fig. 6.
Antalis weinkauffi – HABE, 1963: 261, pl. 38, fig. 30. textfig. 27; 1971: 488 (Japanese text): 307, (English). pl. 65, figs 12-13; 1977: 333, pl. 70, figs 1-4. — HABE & KOSUGE, 1964: 5. — SPRINGSTEEN & LEOBRERA, 1985: 287, pl. 82, fig. 7. — QI & MA, 1989: 118. — HIGO & GOTO, 1993: 686.
Antalis weinkauffi weinkauffi – HABE & KOSUGE, 1964: 5.

TYPE MATERIAL. — *D. weinkauffi*: holotype ZMB 101996 (*fide* KILIAS, 1995). — *A. septentrionalis*: NSMT (*fide* HABE, 1963).

TYPE LOCALITY. — *D. weinkauffi*: Japan. — *A. septentrionalis*: Japan, off Hachinoe, Honshu, 30 m.

MATERIAL EXAMINED. — **Japan**. Coll. JOUSSEAUME, 2 dd. — Kadena, Okinawa, Coll. STAADT, 1 dd. — Kii, Japan, Coll. STAADT, 1 dd (all MNHN).
New Caledonia. MUSORSTOM 4: stn CP 189, 19°07′ S, 163°29′ E, 210 m, 1 dd.
LAGON: stn 267, 22°16′ S, 166°17′ E, 26 m, 1 dd.
West Indian Ocean. MD 32 Réunion: stn CP 41, 21°21′ S, 55°27′ E, 75 m, 4 dd. — Stn DC 43, 21°21′ S, 55°27′ E, 73-77 m, 5 dd. — Stn DC 86, 20°59′ S, 55°15′ E, 75-90 m, 2 lv, 3 dd. — Stn DC 126, 20°52′ S, 55°38′ E, 110 m, 1 dd.

Source : MNHN, Paris

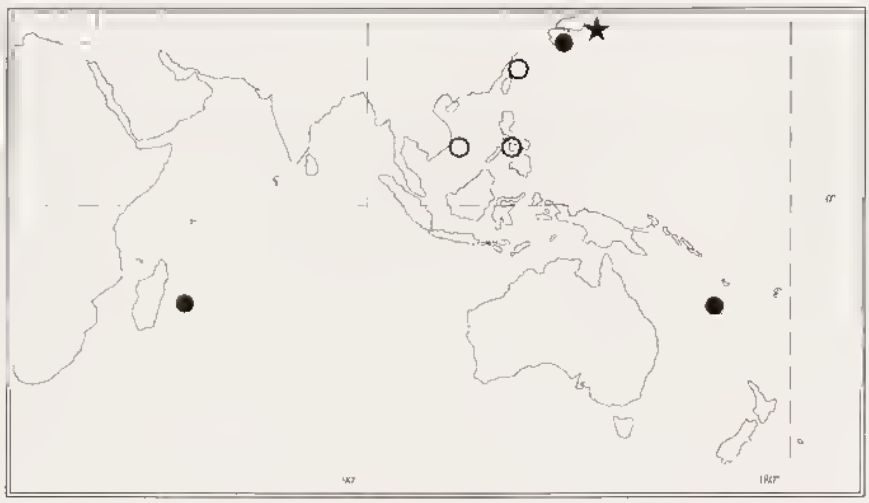


FIG. 36. — Distribution of *Antalis weinkauffi*.

DISTRIBUTION. — Japan, 30-500 m (HABE & KOSUGE, 1964); East and South China Seas, 67-195 m (QI & MA, 1989); the Philippines (SPRINGSTEEN & LEOBRERA, 1985). Now extended to New Caledonia and Réunion Island, alive in 75-90 m.

Antalis usitatum (Smith, 1894)

Figs 37, 45 d

Dentalium usitatum Smith, 1894: 168, pl. 4, fig. 16.

Other references:

Dentalium usitatum – SMITH, 1906a: 250. — PILSBRY & SHARP, 1897: 29, pl. 10, figs 68-69. — WINCKWORTH, 1940a: 25.
Graptacme usitatum – HABE & KOSUGE, 1964: 5.
Dentalium (Antalis) usitatum – LUDBROOK, 1954: 99, fig. 4.

FIG. 37. — Distribution of *Antalis usitatum*.

Source : MNHN, Paris

TYPE MATERIAL. — Holotype presumably in the Zoological Survey of India (not seen); paratype BMNH 1894.9.11.8, Gulf of Bengal, 1094 m.

TYPE LOCALITY. — Off Colombo, *"Investigator"*, 06°32′ N, 79°37′ E, 675 fms [1542 m].

MATERIAL EXAMINED. — Paratype in BMNH.
New Caledonia. BIOCAL: stn CP 57, 23°44′ S, 166°58′ E, 1490-1620 m, 1 dd.
Indonesia. CORINDON: stn B 244, 00°57′ S, 119°22′ E, 970 m, 1 dd.
Philippines. MUSORSTOM 2: stn CP 55, 13°54′ N, 119°58′ E, 865 m, 1 lv.

DISTRIBUTION. — Indonesia to the Bay of Bengal, the Maldives and the Gulf of Aden, in 183-1542 m (LUDBROOK, 1954), now extended to the Philippines and New Caledonia; living in 865 m (present paper).

Antalis tibanum (Nomura, 1940)

Figs 38, 45 e

Dentalium (Antalis) tibanum Nomura, 1940: 101, pl. 1, figs 11-11a.

Synonyms:

Dentalium entalis var. *indicum* Boissevain, 1906: 44, pl. 6, fig. 15 (*non Dentalium indicum* Chenu, 1843).
Antalis boissevainae Palmer, 1974b: 124. *Nom. nov. pro Dentalium entalis* var. *indicum* Boissevain, 1906 *non* Chenu, 1843 (**Syn. nov.**).

Other references:

Dentalium pretiosum — HIRASE, 1931: 136, pl. 3, fig. 6.
Dentalium lubricatum — HIRASE, 1931: 138, pl. 3, fig. 9.
Antalis tibanum — HABE, 1963: 262, pl. 38, fig. 14; 1971: 488 (Japanese text), 307 (English text), pl. 65, figs 6-7.
Antalis indicum — HABE & KOSUGE, 1964: 4.
Antalis indicum tibanum — HABE & KOSUGE, 1964: 4.
Antalis tibana — HABE 1977: 333. — SPRINGSTEEN & LEOBRERA, 1985: 287, pl. 82, fig. 10. — HABE *et al.*, 1986: 24. — HIGO & GOTO, 1993: 686.

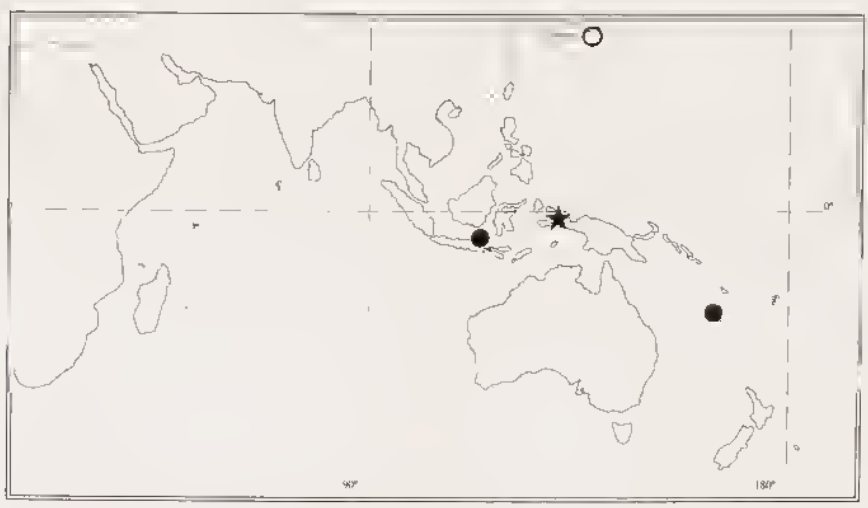


FIG. 38. — Distribution of *Antalis tibanum*.

TYPE MATERIAL. — *D. entalis* var. *indicum*: lectotype (here designated) ZMA.

TYPE LOCALITY. — *D. entalis* var. *indicum*: Indonesia, *"Siboga"*, stn 159, 00°59′1 S, 129°48.8′ E, 411 m. — *D. tibanum*: Japan, off Boso Peninsula.

Source : MNHN, Paris

MATERIAL EXAMINED. — The type material of *D. entalis* var. *indicum*.
New Hebrides Arc. VOLSMAR: stn DW30, 22°17′ S, 171°18′ E, 450-550 m, 8 dd.
Indonesia. *"Snellius"* II: stn 4.128, 08°18′ S, 118°16′ E, 700-835 m, 1 lv, 2 dd (RMNH).

DISTRIBUTION. — From Japan, 0-200 m (HABE & KOSUGE, 1964) to Indonesia. Now extended to New Hebrides Arc, alive in 700-835 m (present paper).

Antalis gardineri (Melvill, 1909)

Figs 39, 45 f

Dentalium gardineri Melvill, 1909: 120, pl. 5, fig. 9.

Other reference:
Dentalium (Antalis) gardineri – LUDBROOK, 1954: 93.

TYPE MATERIAL. — Holotype BMNH 1910.3.17.12.

TYPE LOCALITY. — Indian Ocean, Amirantes Is., 293-383 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. *"Vauban"* 1978-79: stn 22, 22°59′ S, 167°17′ E, 540-545 m, 1 dd. — Stn 33, 22°33′ S, 166°25′ E, 290-350 m, 4 dd.
SMIB 2: stn DW 21, 22°40′ S, 167°41′ E, 460-500 m, 1 dd. — Stn DW 23, 22°31′ S, 167°37′ E, 410-420 m, 1 dd.
CHALCAL 2: stn DW 73, 24°40′ S, 168°38′ E, 573 m, 1 dd. — Stn DW 74, 24°40′ S, 168°38′ E, 650 m, 2 dd. — Stn DW 75, 24°39′ S, 168°40′ E, 600 m, 1 dd.
BIOGEOCAL: stn DW 308, 20°40′ S, 166°58′ E, 510-590 m, 1 lv, 3 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 410, 20°38′ S, 167°07′ E, 490 m, 1 lv, 2 dd.
New Hebrides Arc. GEMINI: stn DW 51, 20°59′ S, 170°03′ E, 450 m, 4 lv, 14 dd.
West Indian Ocean. BENTHEDI: stn DR 28, 12°42′ S, 45°20′ E, 705 m, 1 dd.

FIG. 39. — Distribution of *Antalis gardineri*.

DISTRIBUTION. — Seychelles. Now extended to NW Madagascar and New Caledonia, live records in 450-590 m.

Source : MNHN, Paris

Antalis perinvolutum (Ludbrook, 1954)

Figs 40, 45 g

Dentalium (Fissidentalium) perinvolutum Ludbrook, 1954: 101, fig. 7.

Other references:
Dentalium (Graptacme) usitatum – Boissevain, 1906: 44, pl. 4, figs 6-8.

Type material. — Holotype BMNH 1952.3.25.65.

Type locality. — *"John Murray"*, stn 185, 13°48′ N, 49°16′ E, 2000 m, Gulf of Aden.

Material examined. — The type material. Specimens identified by Boissevain (1906) as *D. usitatum* in ZMA.
Indonesia. CORINDON: stn DR 231, 00°05′ N, 119°48′ E, 1080 m, 1 lv, 1 dd.

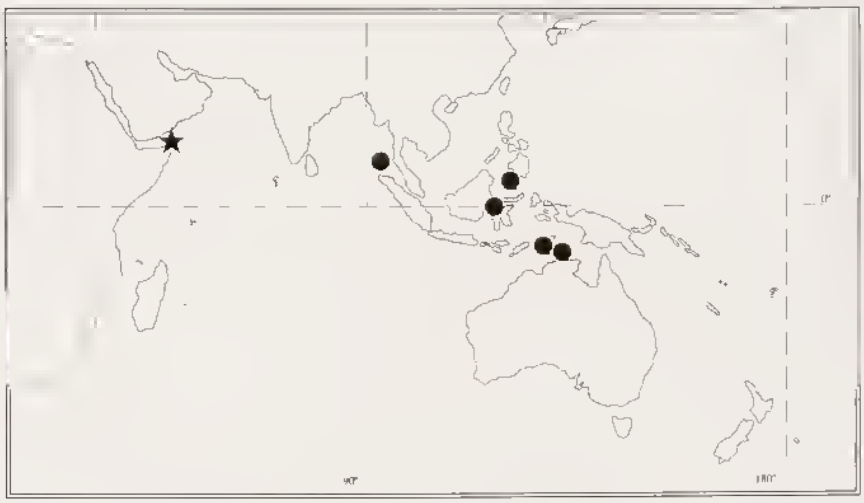


Fig. 40. — Distribution of *Antalis perinvolutum*.

Distribution. — Indonesia, Andaman Sea and Gulf of Aden, 918-2000 m. Alive in 918-1080 m.

Antalis phaneum (Dall, 1895)

Figs 41, 45 i

Dentalium phaneum Dall, 1895: 686, pl. 26, fig. 1.

Other references:
Dentalium phaneum – Boss *et al.*, 1968: 253. — Kay, 1979: 586, fig. 193F.

Type material. — Holotype USNM 107025, paratypes USNM 107026.

Type locality. — *"Albatross"*, stn 3476, near Sandwich [Hawaii] Is., 298 fms [545 m].

Material examined. — The type material.

Source : MNHN, Paris

New Caledonia. BIOGEOCAL: stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 23 lv.
BIOCAL: stn DW 56, 23°35′ S, 167°12′ E, 695-705 m, 1 lv. — Stn CP 75, 22°19′ S, 167°23′ E, 825-860 m, 8 lv. — Stn DW 106, 21°36′ S, 166°29′ E, 625-650 m, 1 dd.
SMIB 2: stn DW 21, 22°40′ S, 167°41′ E, 460-500 m, 7 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 488, 20°49′ S, 167°06′ E, 800 m, 1 dd.
French Polynesia. 11°22′ S, 139°43′ W, 614 m, J. Poupin-SMCB coll., 3 lv (MNHN).

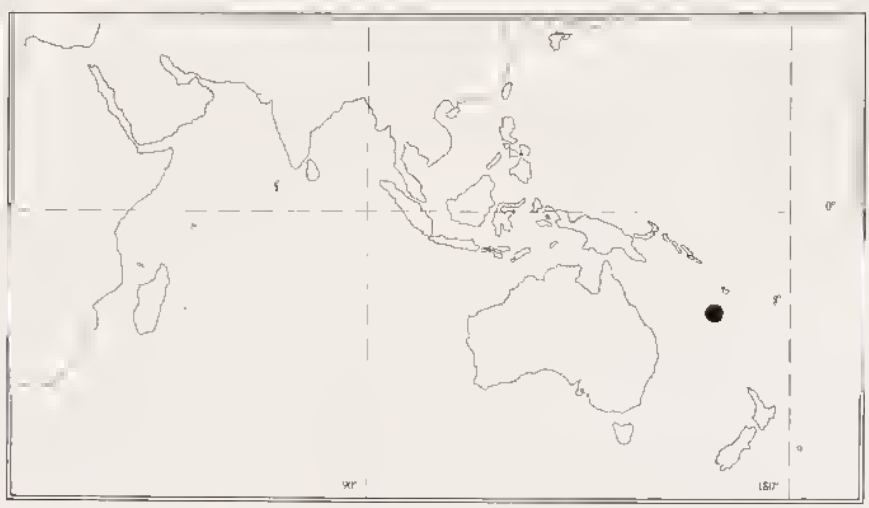


FIG. 41. — Distribution of *Antalis phaneum*.

DISTRIBUTION. — Central and South Western Pacific from Hawaii to French Polynesia and New Caledonia, live records in 614-860 m.

Antalis boucheti sp. nov.

Figs 42, 45 h, j, 73 g

TYPE MATERIAL. — Holotype MNHN. Paratypes: 12 MNHN, 1 AMS C201723, 1 NMNZ M268959, 1 USNM.

TYPE LOCALITY. — Loyalty Islands, MUSORSTOM 6, stn 428, 20°24′ S, 166°13′ E, 420 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn CC 175, 18°59′ S, 163°17′ E, 355 m, 1 dd (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 397, 20°47′ S, 167°05′ E, 380 m, 4 dd (2 paratypes: 1 MNHN, 1 USNM). — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 1 dd. — Stn DW 406, 20°41′ S, 167°07′ E, 373 m, 1 dd (paratype). — Stn DW 411, 20°40′ S, 167°03′ E, 424 m, 1 lv, 1 dd (paratypes). — Stn DW 413, 20°40′ S, 167°03′ E, 463 m, 1 dd. — Stn DW 428, 20°24′ S, 166°13′ E, 420 m, 3 lv (holotype and paratypes), 3 dd (paratypes: 1 MNHN, 1 AMS, 1 NMNZ). — Stn DW 444, 20°54′ S, 167°18′ E, 300 m, 2 dd. — Stn DW 446, 20°54′ S, 167°19′ E, 360 m, 1 lv, 2 dd (1 paratype lv, 1 paratype dd). — Stn DW 451, 20°59′ S, 167°25′ E, 330 m, 5 dd (1 paratype). — Stn DW 481, 21°22′ S, 167°50′ E, 300 m, 1 lv (paratype), 4 dd.
Philippines. MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd.

DISTRIBUTION. — New Caledonia and the Philippines. Alive from 360 to 424 m, shells down to 842 m.

Source : MNHN, Paris

FIG. 42. — Distribution of *Antalis boucheti*.

DESCRIPTION. — *Shell* to 50 mm long, white to yellow, solid, polished, very slightly curved, rapidly tapering to apex, 16 to 18 rounded primary angled ribs. Secondary ribs begin near the apex, 58 in number at mouth. Transversal sculpture of fine and dense subequal striae, round in section. Under magnification, the longitudinal and transverse sculpture give this species a reticulate appearance. Apex fine with a deep fissure in fresh specimens, but this is usually missing due to breakage or wear.

Measurements: holotype L 42, W 4.4, w 0.7, a 1; mean of 8 paratypes L 32.2, W 3.71, w 0.67, arc 0.66. W/w ratio 3.9-6.3.

ETYMOLOGY. — Named after Dr Philippe BOUCHET, who contributed to this monograph all the way from collecting the material in the field to reviewing and editing my manuscript.

Antalis guillei sp. nov.

Figs 43, 45 k

TYPE MATERIAL. — Holotype MNHN. Paratypes: 11 MNHN, 1 NMP.

TYPE LOCALITY. — West Indian Ocean, MD 32 Réunion, stn DC 136, 20°46′ S, 55°36′ E, 915-922 m.

MATERIAL EXAMINED. — **West Indian Ocean.** MD 32 Réunion: stn FA 40, 21°21′ S, 55°27′ E, 150 m, 4 dd. — Stn DR 47, 21°23′ S, 55°37′ E, 205-215 m, 7 dd. — Stn DC 56, 21°05′ S, 55°12′ E, 170-225 m, 8 dd (7 paratypes MNHN, 1 paratype NMP). — Stn DC 136, 20°46′ S, 55°36′ E, 915-922 m, 5 dd (holotype and 4 paratypes).

DISTRIBUTION. — Réunion Island. Shells only in 150-915 m.

DESCRIPTION. — *Shell* to 9 mm long, well arched, translucent. Sculpture of 10 primary ribs. Secondary ones begin equal in strength to, but less prominent than the primary ribs near the anterior aperture where both are present. Conspicuous growth lines also present. Apex simple, straight, lacking callus. Mouth thin, slightly depressed ventrally.

Measurements: holotype L 8.7, W 0.9, w 0.3, arc 0.8; paratypes L 7.5, W 0.7, w 0.3, arc 0.7; L 8.6, W 0.9, w 0.4, arc 0.8; L 9, W 0.9, w 0.4, arc 0.9; L 8.7, W 0.8, w 0.3, arc 0.6; L 8.5, W 0.8, w 0.3, arc 0.8. W/w ratio 2.3-3.

REMARKS. — Despite the small size, specimens appear to be mature.

ETYMOLOGY. — Named for Dr Alain GUILLE, now at Laboratoire Arago, Banyuls, formerly curator of Echinoderms at MNHN and senior scientist of Marion-Dufresne cruise MD 32.

Source : MNHN, Paris

FIG. 43. — Distribution of *Antalis guillei*.

Other Indo-Pacific species of *Antalis* cited in the literature

Antalis diarrhox (Watson, 1879): 511. *"Challenger"*, stn 169, 37°34′ S, 178°22′ E, 700 fms [1280 m], New Zealand. Holotype BMNH 1887.2.9.65.

Antalis glaucarena (Dell, 1953): 48. Chatham Rise, New Zealand, 200-300 fms [366-548 m]. NMNZ.

Antalis inflexum (Sowerby, 1903): 224, pl. 5, fig. 11. South Africa, Natal, Tugela River mouth, 14 fms [26 m]. Paratype SAM A9364.

Antalis marukawai (Otuka, 1933): 159, textfig. 1a-f. Off Koshikizima, Satuma, Japan, 200 m. Central Fisheries Experimental Station, Japan.

Antalis suteri (Emerson, 1954): 185, *nom. nov. pro D. arenarium* Suter, 1907. Stewart Island, New Zealand, 18 fms [33 m]. New Zealand Geological Survey, Wellington (*fide* DANCE, 1986); paratype South Australian Museum D16001 (*fide* ZEIDLER & MACPHAIL, 1978).

Antalis tosaensis (Habe, 1963): 23, pl. 2, fig. 2. Tosa Bay, Shikoku, 200 m. NSMT.

Genus *PLAGIOGLYPTA* Pilsbry *in* Pilsbry & Sharp, 1897

Type species (OD): *Dentalium undulatum* Münster, 1844. Carboniferous.

DIAGNOSIS. — *Shell* medium to large, almost straight, solid, polished, shiny, white. Sculptured at apex by close-set, fine, encircled wrinkles; prominent, oblique growth lines over the entire shell. Apex simple or with a flat V-shaped notch. Subcircular in section, slightly compressed dorsoventrally. *Radula* rachidian similar to *Dentalium*, but with smooth anterior margin; lateral with large primary cusp; marginal short, sinusoidal.

DISTRIBUTION. — Ordovician (*fide* EMERSON, 1962)-Recent. SW Pacific and Indian Ocean in temperate and cold water, absent in the Atlantic Ocean; shelf-bathyal.

Plagioglypta pertracheata (Plate, 1908)

Figs 44, 45 l-m

Dentalium (Plagioglypta) pertracheatum Plate, 1908a: 357, pl. 30, figs 45-46.

Source : MNHN, Paris

TYPE MATERIAL. — Lectotype, designated by KILIAS (1995), ZMB 61099a (not seen).

TYPE LOCALITY. — *"Valdivia"*, stn 185, 03°41′ S, 100°59′ E, 614 m, SW Sumatra.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 lv, 6 dd.
BIOGEOCAL: stn CP 214, 22°43′ S, 166°28′ E, 1590-1665 m, 4 dd.
West Indian Ocean. BENTHEDI: stn DS 42, 13°05′ S, 45°08′ E, 400-520 m, 1 lv. — Stn F 49, 12°55′ S, 44°57′ E, 300-450 m, 2 dd. — Stn F 61, 12°46′ S, 44°58′ E, 475-510 m, 2 lv, 5 dd. — Stn DS 64, 12°41′ S, 44°57′ E, 770-860 m, 1 dd. — Stn F 68, 12°30′ S, 45°02′ E, 400-460 m, 1 dd. — Stn DS 71, 12°30′ S, 45°02′ E, 450 m, 1 lv, 4 dd.
MD 32 Réunion: stn CP 60, 21°03′ S, 55°10′ E, 460-490 m, 1 lv. — Stn DC 58, 21°03′ S, 55°10′ E, 450 m, 4 lv, 6 dd. — Stn DS 178, 21°04′ S, 55°10′ E, 412-460 m, 3 lv, 7 dd.

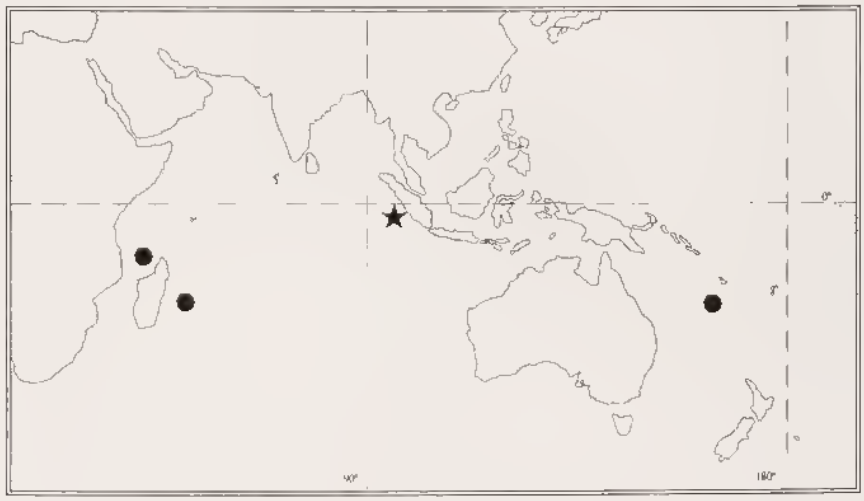


FIG. 44. — Distribution of *Plagioglypta pertracheata*.

DISTRIBUTION. — W Indonesia, now extended to New Caledonia, Réunion Island and NW Madagascar, live records in 460-1740 m.

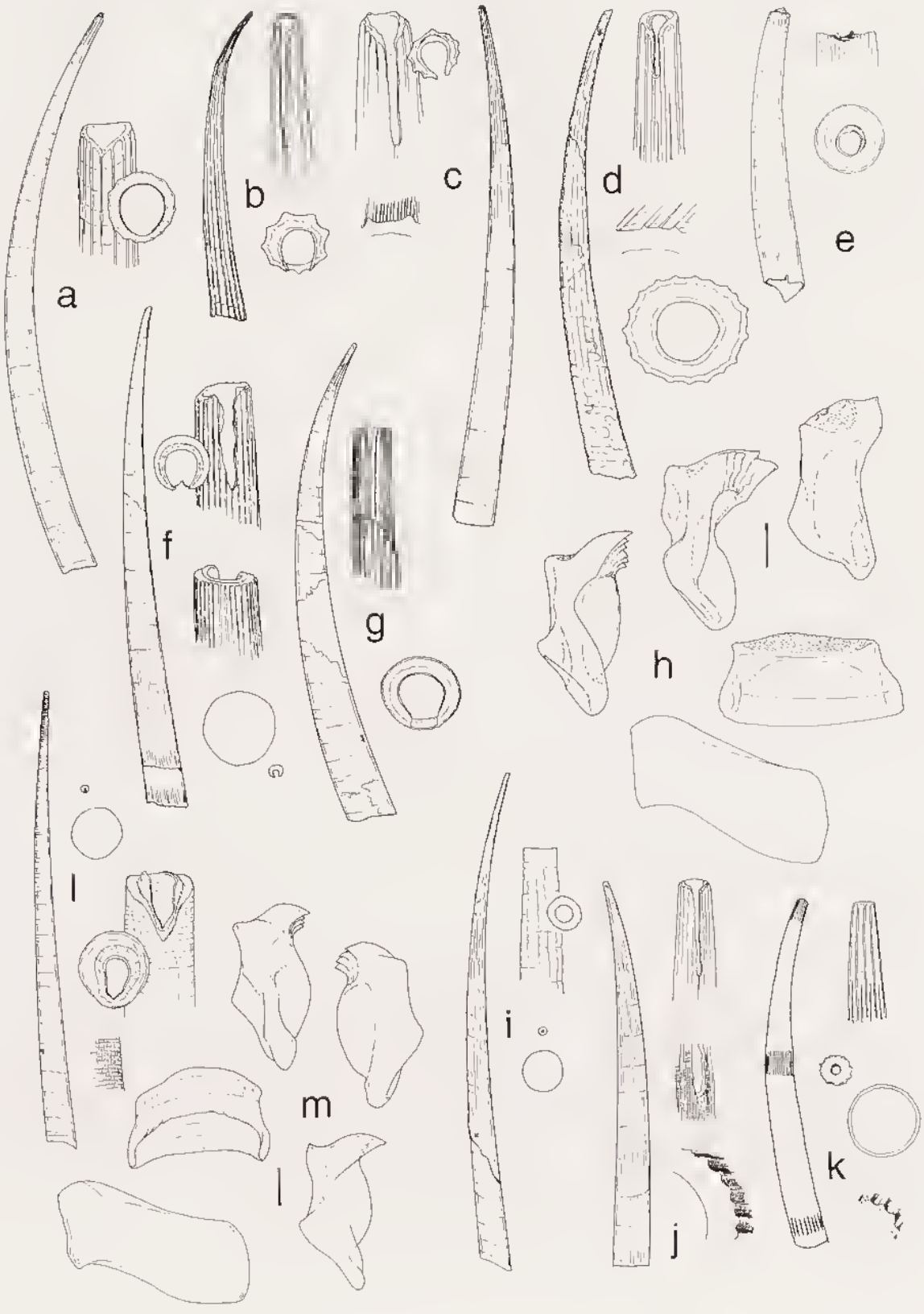
Genus *STRIODENTALIUM* Habe, 1964a

Type species (OD): *Dentalium rhabdotum* Pilsbry, 1905. Recent.

DIAGNOSIS. — *Shell* medium to large, slightly curved to almost straight, solid, opaque, light brown. Longitudinal sculpture of 7-8 primary ribs; secondary ribs present, variable in number. Rib section angled, smooth or sculptured. Intercostal spaces concave, smooth or sculptured with longitudinal striae. Apex simple, section starlike at apex, starlike to polygonal at mouth.
Radula rachidian with the granulose anterior border; lateral with prominent primary cusp, head granulose; marginal sinusoidal.

DISTRIBUTION. — Recent, Pacific and Indian Oceans, temperate and cold waters. Absent in the Atlantic Ocean. Shelf to bathyal.

Source : MNHN, Paris



Source : MNHN, Paris

Striodentalium thetidis (Hedley, 1903)

Figs 46, 52 b

Dentalium thetidis Hedley, 1903: 327, fig. 61.

Other references:

Dentalium thetidis – Hedley, 1918: 112.
Entalinopsis (Entalinopsis) thetidis – Habe & Kosuge, 1964: 8.

Type material. — 2 syntypes dd AMS C16212.

Type locality. — Off Port Kembla, New South Wales, Australia, 115-137 m.

Material examined. — The type material.
Philippines. MUSORSTOM 3: stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 2 dd.

Fig. 46. — Distribution of *Striodentalium tethidis*.

Distribution. — Southeastern Australia, now extended to the Philippines; shells in 115-214 m.

Fig. 45. — a, *Antalis longitrorsum*, shell (80 mm), apex and apical section, Tuléar, (MNHN). — **b**, *Antalis porcatum*, shell (18 mm), apex and apical section, MD 32 Réunion: stn DC 86. — **c**, *Antalis weinkauffi*, shell (68 mm), apex, apical section, detail of the sculpture, New Caledonia LAGON: stn 267. — **d**, *Antalis usitatum*, shell (45.5 mm), apex, detail of the sculpture, CORINDON: stn B 244. — **e**, *Antalis tibanum*, shell (21 mm), apex and apical section, VOLSMAR: stn DW 30. — **f**, *Antalis gardineri*, shell (63 mm), apex, apical and oral sections, GEMINI: stn DW 51. — **g**, *Antalis perinvolutum*, shell (68 mm), apex, and apical section, CORINDON: stn DR 231. — **h**, *Antalis* type radula (*A. boucheti* sp. nov.). — **i**, *Antalis phaneum*, shell (37 mm), apex, apical and oral sections, BIOGEOCAL: stn CP 232. — **j**, *Antalis boucheti* sp. nov., holotype, shell (42 mm), apex and detail of the sculpture. — **k**, *Antalis guillei* sp. nov., holotype, shell (8.7 mm), apex, apical and oral sections, section of the ribs and detail of sculpture. — **l**, *Plagioglypta pertracheata*, shell (60 mm), apex, apical and oral sections, detail of the sculpture, BENTHEDI: stn F 61. — **m**, *Plagioglypta* type radula (*P. pertracheata*). Scale lines: 100 µm (h, m).

Source : MNHN, Paris

Striodentalium rhabdotum (Pilsbry, 1905)

Figs 47, 52 a, d

Dentalium rhabdotum Pilsbry, 1905: 116, pl. 5, figs 45-47.

Other references:

Dentalium (Antalis) rhabdotum – Kuroda & Kikuchi, 1933: 8, pl. 1, figs 1-2.
Dentalium (Dentale) rhabdotum – Habe, 1953: 294; 1957: 129, fig. 11.
Antalis rhabdotum – Habe, 1962: 106, pl. 47, fig. 12; 1963: 263, pl. 38, figs 17-18. — Habe & Kosuge, 1964: 5. — Okutani, 1964: 73.
Striodentalium rhabdotum – Okutani, 1966: 12. — Habe, 1964a: 22, pl. 2, figs 17-18; 1971: 489 (Japanese text), 307 (English text), pl. 65, figs 4-5. — Habe, 1977: 334, pl. 72, fig. 5. — Habe *et al.*, 1986: 24, pl. 1, figs 11-12. — Qi & Ma, 1989: 118, figs 10a-b. — Higo & Goto, 1993: 687.

Type material. — Holotype ANSP 88319.

Type locality. — Heda, Izu, Japan, 306 m.

Material examined. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DW 341, 19°46′ S, 158°43′ E, 620-630 m, 3 dd.
Indonesia. *"Snellius"* II: stn 4.135, 06°29′ S, 121°09′ E, 495 m, 2 lv, 3 dd. — Stn 4.267, 08°18′ S, 118°21′ E, 650 m, 1 dd.
Philippines. MUSORSTOM 1: stn CP 44, 13°47′ N, 120°30′ E, 592-610 m, 8 dd.
MUSORSTOM 2: stn CP 82, 13°46′ N, 120°28′ E, 550 m, 5 lv.
MUSORSTOM 3: stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 6 lv, 60 dd. — Stn CP 118, 11°58′ N, 121°06′ E, 448-466 m, 1 lv, 3 dd. — Stn CP 122, 12°20′ N, 121°42′ E, 219-220 m, 2 dd.

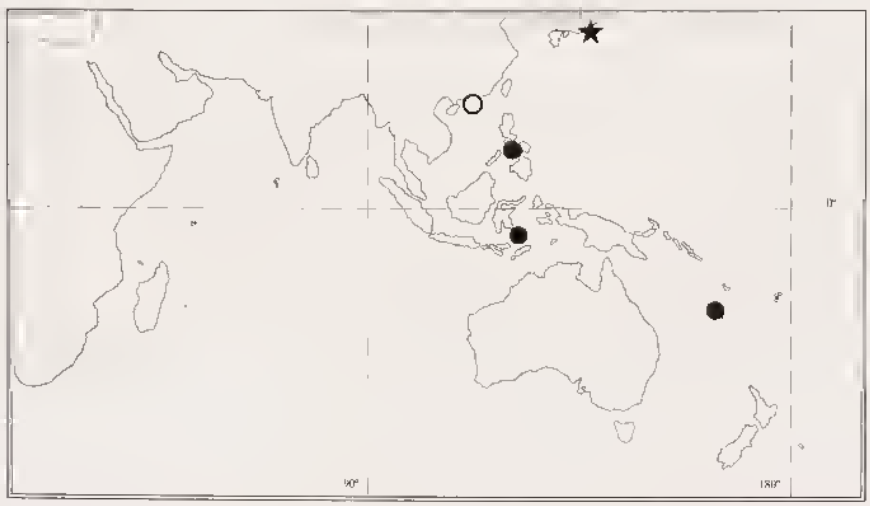


Fig. 47. — Distribution of *Striodentalium rhabdotum*.

Distribution. — Japan, from 61 m to 1350 m (Habe, 1957 and Okutani, 1964); East and South China Seas, 300-550 m (Qi & Ma, 1989). Now extended to the Philippines and New Caledonia. Live records in 448-668 m.

Source : MNHN, Paris

Striodentalium kanakorum sp. nov.

Figs 48, 52 c

TYPE MATERIAL. — Holotype and 3 paratypes MNHN.

TYPE LOCALITY. — New Caledonia, Coral Sea, CHALCAL 2, stn DW 74, 24°40′ S, 168°38′ E, 650 m.

MATERIAL EXAMINED. — **New Caledonia**. CHALCAL 2: stn DW 72, 24°55′ S, 168°22′ E, 527 m, 1 lv (paratype). — Stn DW 73, 24°40′ S, 168°38′ E, 573 m, 1 dd (paratype). — Stn DW 74, 24°40′ S, 168°38′ E, 650 m, 1 lv (holotype).
MUSORSTOM 4: stn DW 197, 18°51′ S, 163°21′ E, 550 m, 1 dd (paratype).

FIG. 48. — Distribution of *Striodentalium kanakorum*.

DISTRIBUTION. — New Caledonia, alive in 527-650 m.

DESCRIPTION. — *Shell* to 32 mm long, solid, regularly curved, white, shiny. Seven primary high, angulate and irregular ribs and one secondary rib at each intercostal concave space. Apex truncate with important callus, wide on dorsal side, lumen drop-like shape. Cross section laterally compressed throughout, mouth thin.

Measurements: holotype L 21, W 2.8, w 1.4, arc 1.3; paratypes L 18.5, W 2.7, w 1.4, arc 1; L 27.6, W 3.1, w 1.4, arc 1.4; L 32, W 3.1, w 1.5, arc 1.5. W/w ratio 2.2-2.

REMARKS. — *S. kanakorum* is shorter, more curved and shiny than the other species of the genus, except *S. thetidis*, but in the latter species the intercostal spaces are finely striated.

ETYMOLOGY. — After Kanak, name of the people of New Caledonia and Vanuatu Islands.

Other Indo-Pacific species of *Striodentalium* cited in the literature

Striodentalium chinensis Qi & Ma, 1986: 69, fig. 1. East China Sea.
Striodentalium concretum (Colman, 1958): 141, fig. 2. E of Sydney, NSW, Australia, 548 m. AMS.
Striodentalium hosoi Habe, 1963: 263, fig. 46. Off Tosa Bay, Shikoku, Japan. NSMT.
Striodentalium polycostatum Qi & Ma, 1986: 69. East China Sea, 184 m.

Source : MNHN, Paris

Genus *Graptacme* Pilsbry & Sharp, 1897

Type species (SD by Woodring, 1925): *Dentalium eboreum* Conrad, 1846. Recent, Tampa Bay, Florida, USA.

Diagnosis. — *Shell* medium to large, slightly to well curved, generally fragile, polished to shiny, except for apical portion; translucent white and salmon near the apex in some species. Sculptured by close, fine, longitudinal striae, prominent near apex; anterior half of shell usually smooth. Apex simple, truncate with apical callus and lumen variable in shape, or with deep irregular slit on dorsum or side in some species. Circular in section, oral aperture generally thin and translucent.
Radula similar to *Dentalium*.

Distribution. — Paleocene-Recent, worldwide; sublittoral of temperate and tropical regions to abyssal.

Graptacme lactea (Deshayes, 1825)

Figs 49, 52 e-f, 71 f, 73 i

Dentalium lacteum Deshayes, 1825: 362, pl. 2, fig. 27.

Other references:

Dentalium lacteum — Sowerby, 1860: 98, pl. 225 (*Dentalium* 3), fig. 48; 1873: pl. 6, fig. 37. — Pilsbry & Sharp, 1897: 99, pl. 19, fig. 1. — Boissevain, 1906: 54, pl. 1, fig. 21, pl. 6, fig. 35.
Eboreidens lacteum — Chistikov, 1975: 19; 1979: 113, fig. 5.

Fig. 49. — Distribution of *Graptacme lactea*.

Type material. — Lectotype (here designated; L 29, W 2.8, w 0.9) and paralectotype, MNHN.

Type locality. — India.

Material examined. — The type material.
Chesterfield Islands. CORAIL 2: stn DW 72, 19°15′ S, 158°21′ E, 32 m, 2 dd. — Stn DW 100, 19°06′ S, 158°27′ E, 40 m, 1 lv. — Stn DW 122, 19°28′ S, 158°17′ E, 32 m, 2 dd. — Stn DW 155, 19°49′ S,

Source : MNHN, Paris

158°25′ E, 42 m, 1 dd. — Stn DW 158, 19°46′ S, 158°17′ E, 28 m, 1 dd. — Stn DW 160, 19°46′ S, 158°23′ E, 35-41 m, 1 lv.
Philippines. Coll. JOUSSEAUME, 3 dd (MNHN).
West Indian Ocean. Seychelles, 2 dd (MNHN).

DISTRIBUTION. — Philippines and China Seas to Indonesia and the Indian Ocean, now extended to the Coral Sea, alive in 32 to 42 m.

REMARKS. — The type specimens are very worn but show typical *Graptacme* sculpture, as noted by BOISSEVAIN (1906: 54). CHISTIKOV (1975) proposed the genus *Eboreidens* and the family Eboreidentidae using *G. lactea* as type species, but giving a description not corresponding to the characteristics of *G. lactea*. I have not seen CHISTIKOV's specimens, but they do not appear to be the present species. Examination of the figure of the radula (CHISTIKOV, 1979b: fig. 5) indicates that CHISTIKOV's species is *Calliodentalium crocinum*. If this is correct, *Eboreidens* and Eboreidentidae are synonyms of *Calliodentalium* and Calliodentaliidae respectively.

Graptacme acutissima (Watson, 1879)

Figs 50, 52 g

Dentalium acutissimum Watson, 1879: 514; 1886: 8, pl. 1, fig. 8.

Other references:

Dentalium acutissimum – PILSBRY & SHARP, 1897: 94, pl. 20, fig. 26. — BOISSEVAIN, 1906: 45, pl. 2, fig. 39, pl. 5, figs 9-12.
D. (Graptacme) acutissimum – PLATE, 1908a: 351.
Graptacme acutissimum – HABE & KOSUGE, 1964: 5. — OKUTANI, 1974: 34.
Graptacme acutissima – HIGO & GOTO, 1993: 687.

TYPE MATERIAL. — Three syntypes BMNH 1887.2.9.31-33. The specimen BMNH 1887.2.9.31 is the figured syntype and will be designated lectotype by LAMPRELL & HEALY (in press). The paralectotype BMNH 1887.2.9.33 belongs to a different species.

TYPE LOCALITY. — Putative lectotype and paralectotype from *"Challenger"* stn 218, 02°33′ S, 144°04′ E, 1070 fms [1956 m], N off Papua New Guinea. Non-conspecific paralectotype from stn 246, 36°10′ N, 178°00′ E, East of Japan, 3758 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOCAL: stn KG 03, 21°15′ S, 166°39′ E, 2340 m, 1 lv. — Stn DS 04, 21°16′ S, 166°40′ E, 2340 m, 2 lv, 6 dd. — Stn CP 05, 21°16′ S, 166°44′ E, 2340 m, 11 dd. — Stn CP 23, 22°46′ S, 166°20′ E, 2040 m, 3 dd. — Stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m, 3 lv, 13 dd. — Stn CP 74, 22°14′ S, 167°29′ E, 1300-1475 m, 1 dd. — Stn DW 79, 20°40′ S, 166°52′ E, 1320-1380 m, 1 dd. — Stn KG 89, 21°03′ S, 166°56′ E, 2070 m, 1 lv, 2 dd. — Stn KG 95, 21°22′ S, 166°33′ E, 2365 m, 1 dd.
BIOGEOCAL: stn CP 238, 21°28′ S, 166°23′ E, 1260-1300 m, 2 lv, 1 dd. — Stn CP 250, 21°25′ S, 166°28′ E, 2350 m, 2 lv, 3 dd. — Stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 1 lv, 8 dd. — Stn CP 266, 21°05′ S, 166°57′ E, 1990-2100 m, 2 dd. — Stn KG 269, 21°02′ S, 166°58′ E, 1810 m, 1 lv, 1 dd. — Stn CP 273, 21°02′ S, 166°57′ E, 1920-2040 m, 1 dd. — Stn CP 321, 21°12′ S, 167°00′ E, 2190-2205 m, 1 dd. — Stn CP 341, 21°30′ S, 166°47′ E, 2334 m, 1 dd.
Indonesia. CORINDON: stn CH 231, 00°05′ N, 119° 48′ E, 980-1080 m, 1 dd.
Philippines. MUSORSTOM 2: stn CP 55, 13°54′ N, 119°58′ E, 865 m, 1 lv, 1 dd.
West Indian Ocean. MD 32 Réunion: stn DS 109, 20°52′ S, 55°06′ E, 1050-1240 m, 1 lv, 1 dd.

Source : MNHN, Paris

FIG. 50. — Distribution of *Graptacme acutissima*.

DISTRIBUTION. — The Philippines, Indonesia, N of Papua New Guinea and East Africa (PLATE, 1908a). Now extended to New Caledonia and Réunion Island. Living records from 1050 to 2350 m, mostly below 1800 m, shells known from 865 m (present paper).

Graptacme africana (Sowerby, 1903)

Figs 51, 52 h

Dentalium africanum Sowerby, 1903: 224, pl. 5, fig. 10.

Other references:
Dentalium africanum – SMITH, 1906b: 58. — BARNARD, 1963b: 351; 1974: 742.

TYPE MATERIAL. — Holotype BMNH 1903.7.27.54, paratype SAM A5491.

FIG. 51. — Distribution of *Graptacme africana*.

Source : MNHN, Paris

TYPE LOCALITY. — North of Untwalumi river, Natal, South Africa, 25 fms [45 m].

MATERIAL EXAMINED. — The type material.
West Indian Ocean. Tuléar, Madagascar, Thomassin coll., 1 dd (BMNH).
South Africa. *"Meiring Naudé"*: stn SM 16, 27°33′ S, 32°35′ E, 384 m, 1 dd.

DISTRIBUTION. — South Africa, now extended to Madagascar, shells from 45 to 384 m.

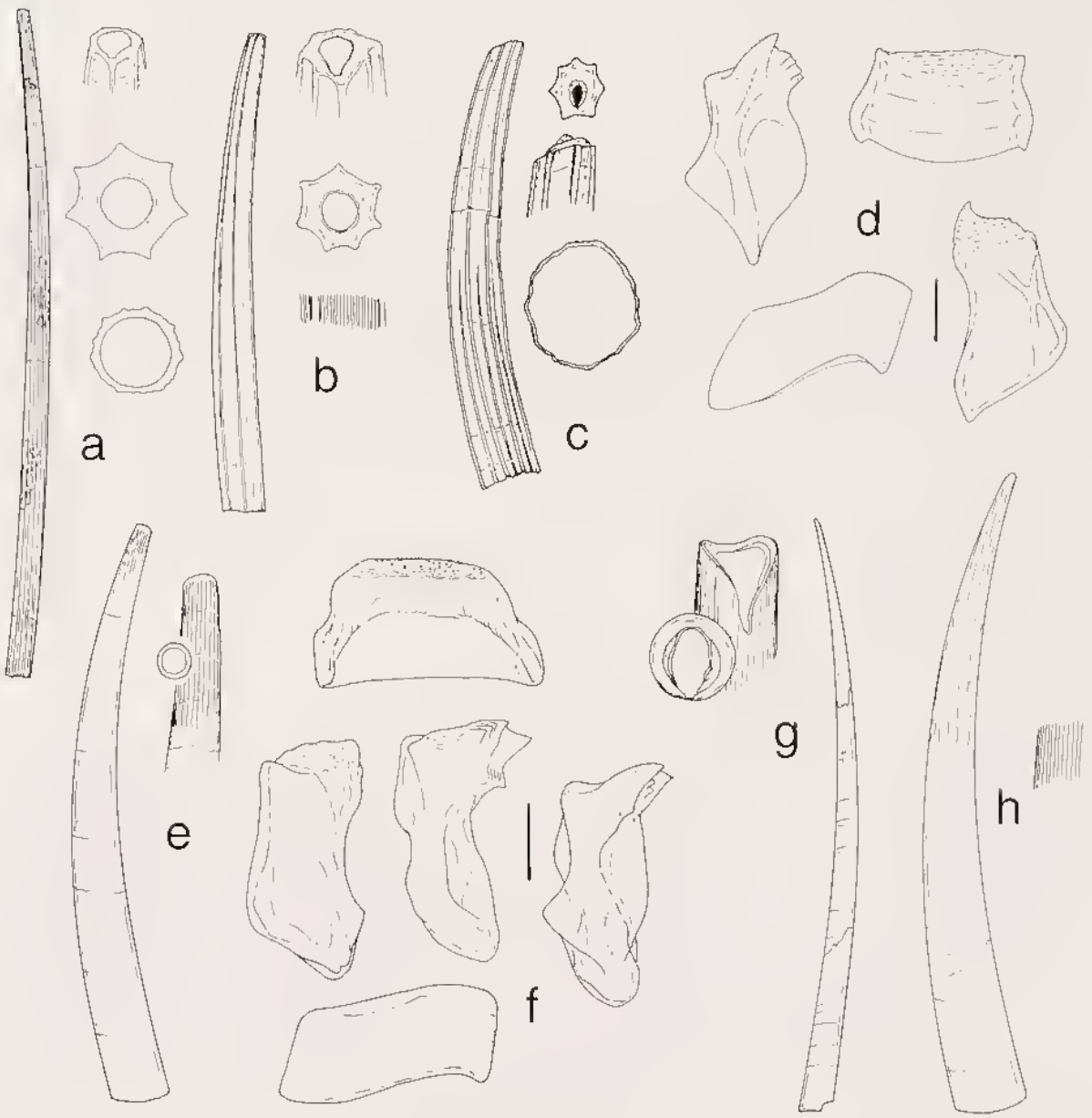


FIG. 52. — **a**, *Striodentalium rhabdotum*, shell (91 mm), apex, apical and oral sections, MUSORSTOM 3: stn CP 106. — **b**, *Striodentalium tethidis*, shell (22 mm), apex and apical section, detail of the sculpture, MNHN, MUSORSTOM 3: stn CP 143. — **c**, *Striodentalium kanakorum* sp. nov., holotype, shell (21 mm), apex, apical and oral sections. — **d**, *Striodentalium* type radula (*S. rhabdotum*). — **e**, *Graptacme lactea*, shell (23 mm), apex and apical section, CORAIL 2: stn CP 160. — **f**, *Graptacme* type radula (*G. lactea*). — **g**, *Graptacme acutissima*, shell (47 mm), apex and apical section, BIOCAL: stn DW 79. — **h**, *Graptacme africana*, shell (44 mm), detail of the sculpture, Tuléar (BMNH). Scale lines: 100 µm (d, f).

Source : MNHN, Paris

Other Indo-Pacific species of *Graptacme* cited in the literature

Graptacme acuticostata (Plate, 1908): 352, pl. 30, fig. 37. Off Dar-es-Salaam, Tanzania, *"Valdivia"*, stn 247, 05°56′ S, 39°1′ E, 50 m. Holotype ZMB 61082 (*fide* KILIAS, 1995).
Graptacme elpis (Winckworth, 1927): 168, pl. 14, figs 6-7. West side of Nannar, Ceylon, 5 m. 2 syntypes BMNH 1952.3.21.13-14.

Genus *Fissidentalium* Fischer, 1885

Type species (by monotypy): *D. ergasticum* Fischer, 1885 (= *D. capillosum* Jeffreys, 1877). Recent, Atlantic Ocean, 1900 m.

DIAGNOSIS. — *Shell* generally very large, moderately curved, solid, opaque or polished, white, cream or light brown, usually with dark-brown markings. Longitudinal sculpture faint with primary ribs variable in number; secondary ribs present, originating near the apex, variable in number and in some species reaching the strength of the primary ribs at the oral area. Rib section round, flat or angled, striated, cancellated or serrated. Intercostal spaces concave or convex, smooth or with longitudinal or transverse striae, generally less prominent than ribs. Apex with a deep irregular slit on ventral side, frequently broken or worn. Section polygonal at apex, circular or subcircular slightly dorsoventrally compressed at oral aperture.
Radula: rachidian strong, well curved with barely granulose anterior margin; lateral strong with short but strong cusps or irregular grooves, anterior part of head usually granulose; marginal large and sinusoidal.

DISTRIBUTION. — Cretaceous-Recent, worldwide, shelf to abyssal.

Fissidentalium profundorum (Smith, 1894)

Figs 53, 62 f, l, 70 a

Dentalium profundorum Smith, 1894: 167, pl. 4, fig. 18.

Other references:

Dentalium profundorum – PILSBRY & SHARP, 1897: 79, pl. 6, fig. 82. — SMITH, 1906a: 249. — BOISSEVAIN, 1906: 37, pl. 4, figs 14-16. — WINCKWORTH, 1940a: 25.
Fissidentalium (*Fissidentalium*) *profundorum* – HABE, 1964a: 13, pl. 1, fig. 15, pl. 5, fig. 59.

TYPE MATERIAL. — Holotype presumably in the Zoological Survey of India; paratype BMNH 1894.9.11.11.

TYPE LOCALITY. — Off Sri Lanka, *"Investigator"*, 06°32′ N, 79°37′ E, 675 fms [1235 m].

MATERIAL EXAMINED. — The paratype.
New Caledonia. BIOCAL: stn CP 57, 23°44′ S, 166°58′ E, 1490-1620 m, 1 dd. — Stn CP 62, 24°19′ S, 167°49′ E, 1395-1410 m, 1 dd.
BIOGEOCAL: stn CP 238, 21°28′ S, 166°23′ E, 1260-1300 m, 10 dd.
Indonesia. CORINDON: stn DR 229, 00°02′ N, 119°50′ E, 411-445 m, 1 lv, 1 dd.
West indian Ocean *"Galathea"*: stn 217, 14°20′ S, 45°09′ E, 3560 m, 2 dd (ZMC).

DISTRIBUTION. — Indian Ocean, Indonesia, Japan, now extended to New Caledonia. Live records in 441-445 m and shells down to 3560 m (present paper).

Source : MNHN, Paris

FIG. 53. — Distribution of *Fissidentalium profundorum*.

Fissidentalium magnificum (Smith, 1896)

Figs 54, 62 b, i, 78 a

Dentalium magnificum Smith, 1896: 371.

Other references:

Dentalium magnificum — PILSBRY & SHARP, 1897: 78, 251. — ALCOCK & ANDERSON, 1898: pl. 7, figs 5-5a. — SMITH, 1904: 7; 1906a: 248; 1906b: pl. 7, figs 5-5a. — BOISSEVAIN, 1906: 37, pl. 2, figs 32-32a. — WINCKWORTH, 1940a: 25.
Fissidentalium (*Fissidentalium*) *magnificum* — HABE & KOSUGE, 1964: 3.

TYPE MATERIAL. — Holotype presumably in the Zoological Survey of India; paratype BMNH 1895.12.13.1.

TYPE LOCALITY. — Off Trincomalee, East coast of Sri Lanka, *"Investigator"*, 08°40' N, 81°27' E, 637-800 fms [1165-1465 m].

MATERIAL EXAMINED. — Paratype in BMNH.
Chesterfield Islands. MUSORSTOM 5: stn CP 323, 21°19' S, 157°58' E, 970 m, 1 lv, 3 dd. — Stn CP 324, 21°15' S, 157°51' E, 970 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 426, 20°25' S, 166°23' E, 610 m, 2 lv. — Stn DW 489, 20°48' S, 167°06' E, 700 m, 1 lv.
Indonesia. CORINDON: stn CH 214, 00°31' N, 117°50' E, 595 m, 1 dd. — Stn CH 240, 00°38' S, 119°34' E, 675 m, 2 lv.
"Snellius" II: stn 4.127, 08°19' S, 118°18' E, 500-550 m, 1 dd. — Stn 4.128, 08°18' S, 118°16' E, 700-835 m, 2 lv, 6 dd. — Stn stn 4.130, 08°18' S, 118°18' E, 700-730 m, 1 lv, 5 dd. — Stn 4.267, 08°18' S, 118°21' E, 650 m, 10 lv, 21 dd. (RMNH).
Philippines. MUSORSTOM 1: stn CP 47, 13°41' N, 120°30' E, 685-757 m, 2 lv, 7 dd.
MUSORSTOM 2: stn CP 24, 13°37' N, 120°42' E, 640-647 m, 1 dd. — Stn CP 25, 13°39' N, 120°43' E, 520-550 m, 1 lv. — Stn CP 55, 13°54' N, 119°58' E, 865 m, 8 lv, 8 dd.
MUSORSTOM 3: stn DR 95, 13°56' N, 119°59' E, 865 m, 13 dd. — Stn DR 102, 14°01' N, 120°18' E, 192 m, 1 dd. — Stn CP 106, 13°47' N, 120°30' E, 640-668 m, 2 dd. — Stn CP 133, 11°58' N, 121°52' E, 334-390 m, 1 dd.
West Indian Ocean. *"Galathea"*: stn 314, 15°54' N, 90°17' E, 2600 m, 2 lv (ZMC).
MD 32 Réunion: stn CP103, 20°42' S, 54°57' E, 2950-2970 m, 2 dd.

Source : MNHN, Paris

FIG. 54. — Distribution of *Fissilentalium magnificum*.

DISTRIBUTION. — Indian Ocean, now extended to the Philippines, Indonesia and New Caledonia, live records in 520-2600 m (present paper).

Fissidentalium shoplandi (Jousseaume, 1894)

Figs 55, 73 a-d

Dentalium shoplandi Jousseaume, 1894: 102.

Synonyms:

Dentalium transversostriatum Boissevain, 1906: 32, pl. 4, fig. 23 (**Syn. nov.**).
Dentalium (*Fissilentalium*) *chuni* Plate, 1908a: 341, pl. 30, figs 1-9 (**Syn. nov.**).

Other references:

Dentalium shoplandi – PILSBRY & SHARP, 1897: 28, pl. 12, fig. 100. — SHOPLAND, 1902: 176. — SMITH, 1904: 7. — BOISSEVAIN, 1906: 31, pl. 1, fig. 12. — (?) MELVILL & STANDEN, 1907: 123. — WINCKWORTH, 1940a: 25.
Fissidentalium (*F.*) *shoplandi* – HABE & KOSUGE, 1964: 3.
Dentalium (*F.*) *shoplandi* – LUDBROOK, 1954: 99.
Dentalium (*F.*) *chuni* – JAECKEL, 1932: 305.

TYPE MATERIAL. — *D. shoplandi*: holotype MNHN. — *D. transversostriatum*: syntypes ZMA 3.06.028-029. — *D. chuni*: lectotype, designated by KILIAS (1995), ZMB 63824.

TYPE LOCALITY. — *F. shoplandi*: 50 miles of Aden, 1243 m. — *F. transversostriatum*: Indonesia, off Selayer, *"Siboga"*, stn 212, 05°55′ S, 120°19′ E, 462 m. — *F. chuni*: *"Valdivia"*, stn 251, 01°41′ S, 41°47′ W, 693 m.

MATERIAL EXAMINED. — The type material of *F. shoplandi* and *F. transversostriatum*.
Loyalty Islands. MUSORSTOM 6: stn DW 425, 20°24′ S, 166°25′ E, 594 m, 2 dd.
Philippines. MUSORSTOM 2: stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 1 lv. — Stn CP 39, 13°03′ N, 122°36′ E, 1030-1190 m, 2 lv, 4 dd. — Stn CP 82, 13°47′ N, 120°29′ E, 550 m, 1 lv.
MUSORSTOM 3: stn CP 123, 12°11′ N, 121°45′ E, 700-702 m, 1 dd. — Stn CP 127, 11°48′ N, 121°30′ E, 464-475 m, 1 dd. — Stn CP 128, 11°50′ N, 121°42′ E, 815-821 m, 1 lv, 1 dd.

DISTRIBUTION. — Indian Ocean, Indonesia and the Philippines, now extended to New Caledonia, live records in 520-1190 m (present paper).

Source : MNHN, Paris

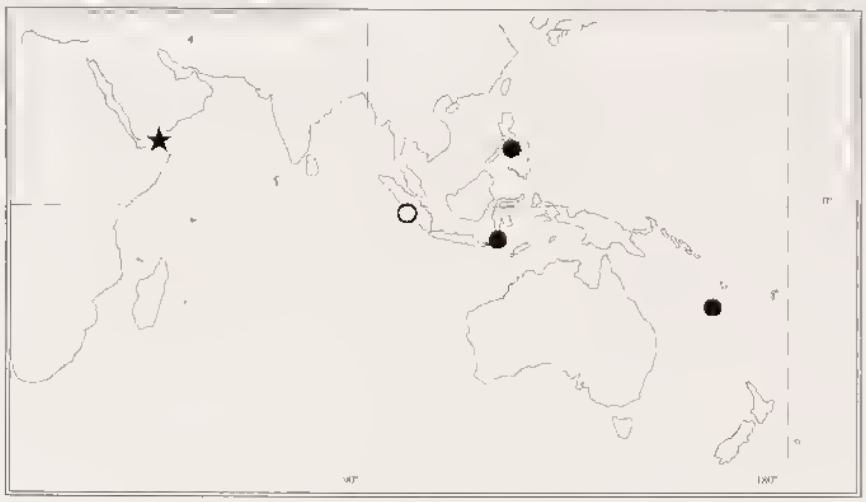


FIG. 55. Distribution of *Fissidentalium shoplandi*.

REMARKS. — The type material of *D. chuni* was not examined but the detailed original description allows us to synonymize it.

Fissidentalium cornubovis (Smith, 1906)

Figs 56, 62 h

Dentalium cornubovis Smith, 1906a: 249.

Other references:

Dentalium cornubovis — ANNANDALE & STEWART, 1909: pl. 23, figs 2-2a. WINCKWORTH, 1940a: 25.
Dentalium ceras — SMITH, 1906a: 248.

TYPE MATERIAL. — Lectotype (here designated) the largest (63 mm) of the 3 syntypes BMNH 1906.10.12.142-144.

TYPE LOCALITY. — Indian Ocean, 1154 fms [2109 m], *"Investigator"*.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn CP 13, 20°20′ S, 167°19′ E, 3690-3740 m, 1 lv, 1 dd. — Stn CP 17, 20°35′ S, 167°25′ E, 3680 m, 1 lv, 2 dd.
West Indian Ocean. BENTHEDI: stn CH 87, 11°44′ S, 47°35′ E, 3716 m, 2 lv.
MD 32 Réunion: stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m, 2 lv.
"Galathea": stn 234, 05°25′ S, 47°09′ E, 4830 m, 3 dd. — Stn 238, 03°23′ S, 44°04′ E, 3960 m, 2 lv, 1 dd (ZMC).
East Indian Ocean. SAFARI 2: stn CP 10, 01°43′ N, 87°08′ E, 4350 m, 1 lv. — Stn CP 12, 02°54′ S, 89°43′ E, 3344 m, 1 lv.
"Galathea": Stn 280, 01°66′ N, 77°09′ E, 4350 m, 1 lv, 8 dd. — Stn 314, 15°54′ N, 90°17′ E, 2600 m, 1 lv (ZMC).

DISTRIBUTION. — Widely distributed throughout the Indian Ocean, now extended to New Caledonia, recorded alive from 2600 to 4350 m.

REMARKS. — The three syntypes of *F. cornubovis* are gerontic individuals, and their ribs fade near the half of the shell. The specimens identified as *Dentalium ceras* by SMITH, 1906 (S of Sri-Lanka, BMNH 1906.10.12.1-2) are adults but not gerontic, and are ribbed throughout.

Source : MNHN, Paris

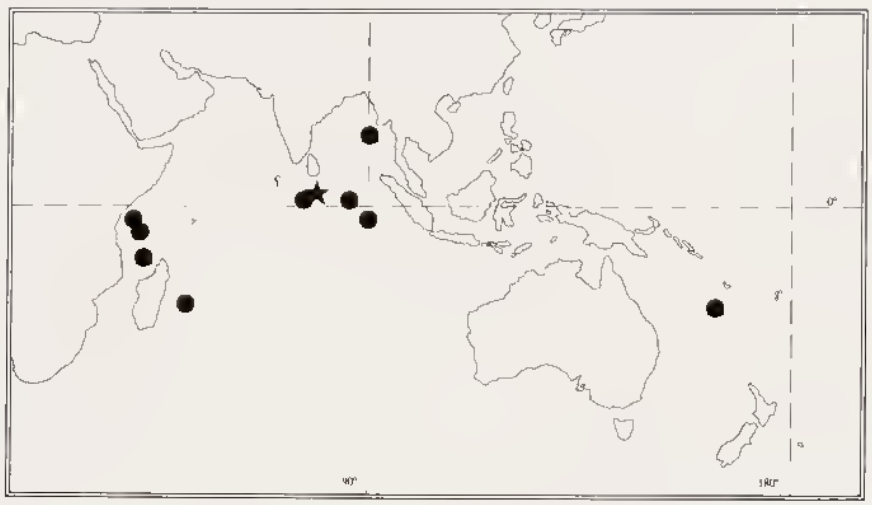


FIG. 56. — Distribution of *Fissidentalium cornubovis*.

Fissidentalium ceras (Watson, 1879), from *"Challenger"* stations 246, 36°10′ N, 178°00′ E, Mid Pacific Ocean E of Japan, 2050 fms [3690 m] and 299, 33°31′ S, 74°43′ W, W of Valparaiso, 2160 fms [3948 m], is here considered a senior synonym of *Fissidentalium megathyris* Dall, 1889, from *"Albatross"*, stn 2807, 00°24′ S, 89°06′ E, 812 fms [1485 m], near Galapagos Islands (holotype USNM 594262). This abyssal species is widely distributed throughout the East Pacific, from Chile to Northern California and the Central Pacific.

Fissidentalium serrulatum (Smith, 1906)

Figs 57, 70 b

Dentalium serrulatum Smith, 1906a: 249.

Other reference:

Dentalium serrulotum — WINCKWORTH, 1940a: 25.

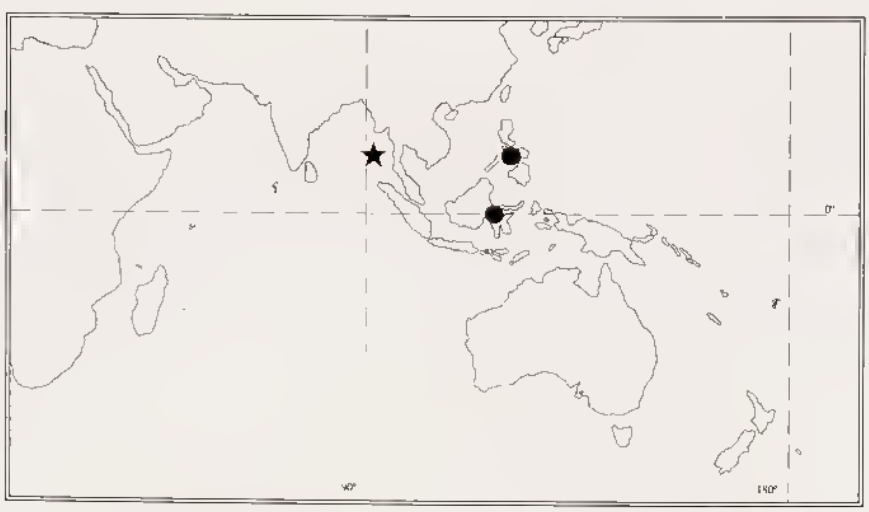


FIG. 57. — Distribution of *Fissidentalium serrulatum*.

Source : MNHN, Paris

TYPE MATERIAL. — Holotype presumably in the Zoological Survey of India; paratype BMNH 1906.10.12.4.

TYPE LOCALITY. — Andaman Is., Gulf of Bengal, 60 fms [110 m].

MATERIAL EXAMINED. — Paratype in BMNH.
Indonesia. CORINDON: stn DR 216, 00°40′ N, 117°51′ E, 96 m, 2 dd.
Philippines. MUSORSTOM 2: stn CP 72, 14°00′ N, 120°18′ E, 182-197 m, 1 dd.

DISTRIBUTION. — Gulf of Bengal, now extended to Indonesia and the Philippines. No records of living material, shells from 96 to 182 m (present paper).

Fissidentalium malayanum (Boissevain, 1906)

Figs 58, 62 d, j

Dentalium malayanum Boissevain, 1906: 32, pl. 5, fig. 45.

Other reference:
Fissidentalium (*F.*) *malayanum* – HABE & KOSUGE, 1964: 3.

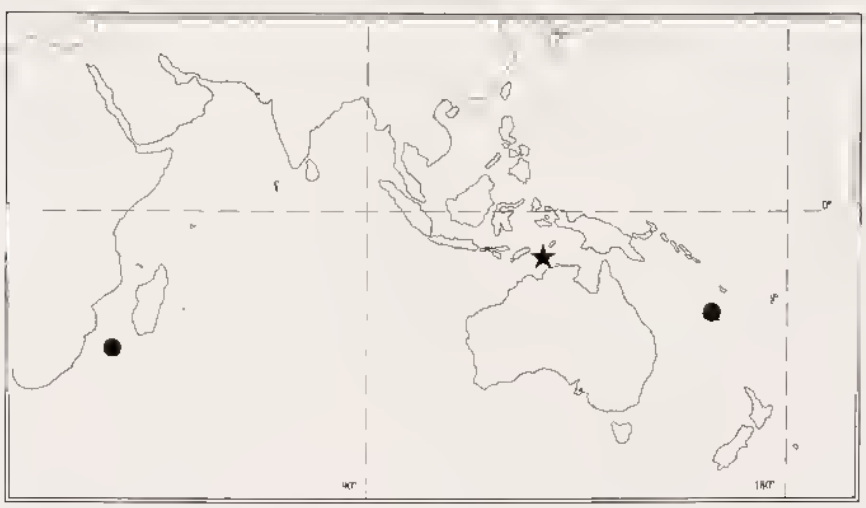


FIG. 58. — Distribution of *Fissidentalium malayanum*.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.033, paralectotypes ZMA 3.06.030-032.

TYPE LOCALITY. — *"Siboga"*, stn 300, 10°49′ S, 123°23′ E, 918 m, Timor Sea.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOCAL: stn KG 03, 21°15′ S, 166°39′ E, 2340 m, 1 dd. — Stn CP 05, 21°16′ S, 166°44′ E, 2340 m, 2 lv, 30 dd. — Stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m, 42 lv, 4 dd. — Stn DS 98, 21°14′ S, 166°30′ E, 2365-2470 m, 3 dd.
BIOGEOCAL: stn CP 250, 21°25′ S, 166°28′ E, 2350 m, 42 dd. — Stn CP 266, 21°05′ S, 166°57′14′ E, 1990-2100 m, 2 dd. — Stn CP 283, 21°22′ S, 166°31′ E, 2370-2375 m, 11 dd. — Stn DW 313, 20°59′ S, 166°59′ E, 1600-1640 m, 1 dd. — Stn CP 321, 21°12′ S, 167°00′ E, 2190-2205 m, 37 dd. — Stn CP

Source : MNHN, Paris

329, 21°09′ S, 166°40′ E, 2315-2310 m, 19 dd. — Stn CP 336, 21°12′ S, 166°22′ E, 2370-2380 m, 11 dd. — Stn CP 341, 21°30′ S, 166°47′ E, 2334 m, 25 dd.
West Indian Ocean. *"Galathea"*: stn 190, 29°42′ S, 39°19′ E, 2760 m, 1 lv, 1 dd (ZMC).

DISTRIBUTION. — Indonesia, now extended to southern Madagascar and New Caledonia. Living from 2100 to 2760 m; shells from 918 m.

Fissidentalium vicdani Kosuge, 1981

Figs 59, 62 c

Fissidentalium vicdani Kosuge, 1981: 114, pl. 39, figs 5-7.

Other reference:
Fissidentalium (F.) vicdani — SPRINGSTEEN & LEOBRERA, 1985: 286, pl. 82, fig. 4.

TYPE MATERIAL. — Holotype, Institute of Malacology, Tokyo IMT 81-36 (not seen).

TYPE LOCALITY. — Bohol, Philippines.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn CP 118, 11°58′ N, 121°06′ E, 448-466 m, 1 dd.

FIG. 59. — Distribution of *Fissidentalium vicdani*.

DISTRIBUTION. — Only known from the Philippines, shell in 448-466 m.

Fissidentalium levii sp. nov.

Figs 60, 70 c

TYPE MATERIAL. — Holotype MNHN. Paratypes: 8 MNHN, 1 AMS C201724, 1 NMNZ M268957.

TYPE LOCALITY. — North of New Caledonia, MUSORSTOM 4, stn DW 160, 18°42′ S, 163°13′ E, 668 m.

Source : MNHN, Paris

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 341, 19°46′ S, 158°43′ E, 620-630 m, 1 dd (paratype). — Stn DC 358, 19°39′ S, 158°47′ E, 680-700 m, 1 dd (paratype).
New Caledonia. BIOCAL: stn DW 33, 23°10′ S, 167°10′ E, 675-680 m, 1 lv (paratype). — Stn DW 39, 22°55′ S, 167°23′ E, 650 m, 1 dd (paratype AMS). — Stn CP 40, 22°55′ S, 167°24′ E, 650 m, 3 dd. — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 1 dd. — Stn DW 48, 23°00′ S, 167°29′ E, 775 m, 2 dd.
MUSORSTOM 4: stn DW 160, 18°42′ S, 163°13′ E, 668 m, 3 lv (holotype and 2 paratypes).
SMIB 2: stn DW 20, 22°44′ S, 167°42′ E, 415-470 m, 2 dd. — Stn DW 21, 22°40′ S, 167°41′ E, 460-500 m, 3 dd.
SMIB 3: stn DW 21, 22°59′ S, 167°19′ E, 525 m, 5 dd (1 paratype).
"Vauban" 1976: Pointe du Grand Récif Sud, 200 m, 1 dd (1 paratype).
"Vauban" 1978-79: stn 14, 22°16′ S, 167°17′ E, 465-495 m, 1 dd. — Stn 22, 22°59′ S, 167°17′ E, 540-545 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 396, 20°48′ S, 167°01′ E, 1400 m, 1 dd (paratype NMNZ).
New Hebrides Arc. GEMINI: stn DW 55, 20°59′ S, 170°02′ E, 710 m, 1 dd (paratype).

FIG. 60. — Distribution of *Fissidentalium levii*.

DISTRIBUTION. — New Caledonia, alive in 668-680 m, shells from 200 to 1400 m.

DESCRIPTION. — *Shell* to 70 mm long, strong, white, shiny, slightly curved, regularly tapering. Sculptured by numerous close riblets often fading near the oral aperture. Apex with a narrow, irregular slit in ventral side in well preserved specimens, slightly compressed dorsally. Mouth fragile, translucent, subcircular in section.

Measurements: holotype L 51.7, W 5.1, w 1.6, arc 1.5; paratypes L 61.5, W 6.5, w 1, arc 2; L 50.7, W 5, w 1.2, arc 1.5; L 44.9, W 5, w 1, arc 1.5., W/w ratio 3.18-6.5.

REMARKS. — This species can be compared with some growth stages of *Antalis gardineri*, but the latter species has better defined and regularly spaced ribs and transverse sculpture.

ETYMOLOGY. - Named for Prof. Claude LÉVI, MNHN, senior scientist of the BIOCAL Expedition, and former head of Marine Invertebrates in MNHN.

Source : MNHN, Paris

Fissidentalium metivieri sp. nov.

Figs 61, 62 a, 70 d-e

TYPE MATERIAL. — Holotype MNHN. Paratypes 10 MNHN, 1 NMP, 1 USNM, 2 BMNH 1994.4041.

TYPE LOCALITY. — West Indian Ocean, SW Madagascar, *"Mascareignes III"*, stn 106, 22°24′ S, 43°03′ E, 600 m.

MATERIAL EXAMINED. — **West Indian Ocean**. SW Madagascar, *"Mascareignes III"*: stn 65, 22°26′ S, 43°05′ E, 520 m, 1 lv (paratype). — Stn 67, 22°26′ S, 43°06′ E, 530 m, 1 dd. — Stn 74, 22°26′ S, 43°03′ E, 540 m, 1 lv, 1 dd. — Stn 76, 22°22′ S, 43°04′ E, 530 m, 2 lv (1 paratype). — Stn 82, 22°11′ S, 43°03′ E, 520 m, 1 lv. — Stn 84, 22°21′ S, 43°04′ E, 535 m, 4 lv (1 paratype). — Stn 88, 22°13′ S, 43°04′ E, 525 m, 2 dd (2 paratypes). — Stn 91, 22°25′ S, 43°04′ E, 535 m, 1 lv. — Stn 95, 22°12′ S, 43°03′ E, 590 m, 4 lv (1 paratype MNHN, 1 paratype NMP). — Stn 97, 22°24′ S, 43°04′ E, 600 m, 3 lv. — Stn 100, 22°23′ S, 43°03′ E, 600 m, 2 lv. — Stn 104, 22°22′ S, 43°03′ E, 610 m, 1 lv (paratype USNM). — Stn 106, 22°24′ S, 43°03′ E, 600 m, 3 lv (holotype and 1 paratype). — Stn 111, 22°17′ S, 43°02′ E, 610 m, 2 lv. — Stn 113, 22°11′ S, 43°02′ E, 650 m, 1 dd. — Stn 122, 22°17′ S, 43°03′ E, 600 m, 1 lv, 4 dd. — Stn 126, 22°18′ S, 43°02′ E, 590 m, 10 lv (2 paratypes), 4 dd. — Stn 127, 22°21′ S, 43°02′ E, 610 m, 8 lv, 2 dd.
Madagasgar. *"Vauban"* Crosnier coll. 1973: stn CH 46, 15°19′ S, 46°12′ E, 400 m, 3 dd. — Stn CH 48, 15°18′ S, 46°12′ E, 480-510 m, 1 dd. — Stn CH 49, 15°18′ S, 46°10′ E, 500-550 m, 2 lv, 10 dd (1 paratype). — Stn CH 50, 15°19′ S, 46°12′ E, 405 m, 1 lv, 1 dd. — Stn CH 88, 18°54′ S, 43°55′ E, 280-310 m, 1 dd. — Stn CH 91, 21°26′ S, 43°15′ E, 425-550 m, 1 dd. — Stn CH 102, 22°30′ S, 42°59′ E, 995-1020 m, 2 dd (paratypes BMNH).

FIG. 61. — Distribution of *Fissidentalium metivieri*.

DISTRIBUTION. — SW Madagascar, Mozambique Channel, alive in 310-650 m, shells to 1020 m.

DESCRIPTION. — *Shell* to 180 mm long, solid, opaque, light brown. Anterior half of shell straight and regularly curved to posterior end, rapidly tapering to apex. Eight primary ribs, of which two latero-dorsal are larger, prominent to mouth. Secondary ribs begin earlier on dorsal than on ventral side, never reaching the strength of the primary ribs. Transverse sculpture cancellate over entire length of shell. Apex with long irregular slit. Mouth straight, section oval dorsoventrally.

Measurements: holotype L 130.9, W 19.6, w 2.4, arc 0.5. W/w ratio 7.1.

Source : MNHN, Paris

REMARKS. — *Fissidentalium metivieri* can be compared to *F. magnificum*, which is more regularly curved, with circular to slightly flattened section, with ribs equal in size and different W/w ratio 5.3/1. *Fissidentalium metivieri* also resembles the fossil *F. rectum* (Linné) in shape, but that species has fine longitudinal striae over the entire surface. *F. exasperatum* is less curved and more sculptured transversally and also has longitudinal striae throughout. *F. metivieri* is the largest known living scaphopod species.

ETYMOLOGY. — Named for Bernard MÉTIVIER, MNHN, who participated in several of the expeditions on which the present report is based, and who assisted in many ways during my visits to Paris.

Other Indo-Pacific species of *Fissidentaliun* cited in the literature

Fissidentalium ceras (Watson, 1879): 510. *"Challenger"* stn 246, 36°10′ N, 178°00′ E, 2050 fms [3747 m]. Mid Pacific E of Japan. Syntypes BMNH 1887.2.9.10-11.

Fissidentalium complexum (Dall, 1895): 687, pl. 26, fig. 3. *"Albatross"*, stn 3472, 256-280 fms [468-512 m], Near Hawaii Is. Holotype USNM 107023.

Fissidentalium eualdes (Barnard, 1963a): 444. Off South Africa, 33°36′ S, 16°15′ E, 2778-2870 m. Syntypes SAM *(fide* BARNARD, 1963b, not seen) and BMNH (1 dd, no registration number).

Fissidentalium exasperatum (Sowerby, 1903): 225, pl. 5, fig. 12. South Africa, Umhloti river mouth, 49 m. 3 syntypes dd BMNH 1903.7.27.57-59.

Fissidentalium lima Kuroda & Habe *in* Habe, 1963: 260, pl. 37, fig. 15. Japan, Okinoshima, Shikoku, 40 m. NSMT.

Fissidentalium horikoshii Okutani, 1982: 1, figs 1-5. E of Japan, 38°22′ N, 143°26′ E, 2930-3020 m. NSMT.

Fissidentalium kawamurai Kuroda & Habe *in* Habe,1962: 106, pl. 47, fig. 14. Ashizurimisaki, Kochi Prefecture, Japan. NSMT.

Fissidentalium laterischismum Shikama & Habe, 1963: 249, textfig. 1-2. Okhotsk Sea, off Monbetsu, Hokkaido, Japan.

Fissidentalium platypleurum (Tomlin, 1931): 339. South Africa, off Itongazi River, Natal, 46 m. SAM.

Fissidentalium salpinx (Tomlin, 1931): 338, fig. 1. Off South Africa, "Cape Point NE 3/4°E 40 miles, 1280-1462 m". SAM.

Fissidentalium tenuicostatum Qi & Ma, 1986: 69. South China Seas.

Fissidentalium yokoyamai (Makiyama, 1931): 44, pl. 1, fig. 1. Yokosuka City, Honshu, Japan.

Fissidentalium zelandicum (Sowerby, 1860): 101, pl. 223 (*Dentalium* 1), fig. 13. New Zealand. BMNH (not seen).

Genus *SCHIZODENTALIUM* Sowerby, 1894

Type species (by monotypy): *Schizodentalium plurifissuratum* Sowerby, 1894.

DIAGNOSIS. — *Shell* long, moderately curved, solid, opaque, cream to light brown. Longitudinally hardly sculptured with primary ribs; secondary ribs present, starting near the apex and reaching almost the size of the primary ones at the oral area. Rib section angled; cancellated. Intercostal spaces concave, sculptured. Apex a fissure furnished with a series of 3-5 elongated holes on the ventral side. Section polygonal.
Radula as in *Fissidentalium*.

DISTRIBUTION. — Cretaceous-Recent, worldwide, shelf to abyssal.

Source : MNHN, Paris

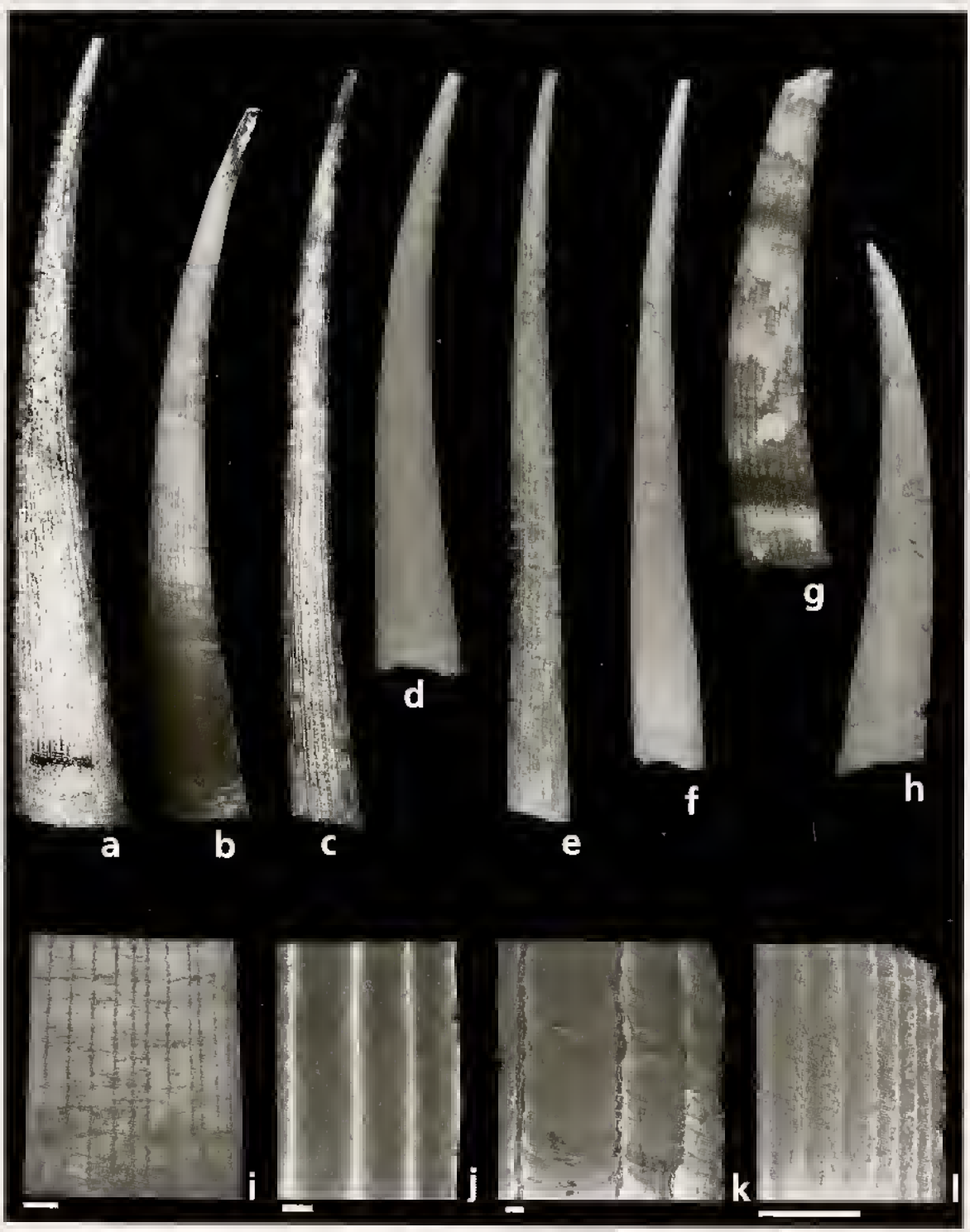


FIG. 62. — **a**. *Fissidentalium metivieri*, holotype (130.9 mm). — **b**, *Fissidentalium magnificum* (115 mm), MUSORSTOM 2: stn CP 25. — **c**, *Fissidentalium vicdani* (114 mm), MUSORSTOM 3: stn CP 118. — **d**, *Fissidentalium malayanum* (55 mm), BIOGEOCAL: stn CP 250. — **e**, *Compressidentalium subcurvatum* (78 mm), CORINDON: stn DR 231. — **f**, *Fissidentalium profundorum* (71 mm), CORINDON: stn DR 229. — **g**. *Pictodentalium festivum* (50 mm), New Caledonia LAGON: stn 424. — **h**, *Fissidentalium cornubovis* (56 mm), BENTHEDI: stn CH 87. — **i**, *F. magnificum*, detail of the sculpture. — **j**, *F. malayanum*, detail of the sculpture. — **k**, *C. subcurvatum*, detail of the sculpture. — **l**. *F. profundorum*, detail of the sculpture. Scale lines: 100 µm (i, j, k), 1 mm (b).

Source : MNHN, Paris

Schizodentalium plurifissuratum Sowerby, 1894

Figs 63, 70 f

Schizodentalium plurifissuratum Sowerby, 1894: 158, pl. 12, fig. 24.

Other references:

Dentalium plurifissuratum – Pilsbry & Sharp, 1897: 82, pl. 6, figs 87-89. — Sowerby, 1903: 231. — Smith, 1906b: 57. — Plate, 1908a: 344, pl. 30. figs 12-16. — Bartsch, 1915: 181. — Barnard, 1963b: 347.
Dentalium multistriatum – Plate, 1908: 437. — Jaeckel, 1932: 304.

Type material. — Holotype BMNH 95.4.29.179, paratypes BMNH 95.4.29.80-81.

Type locality. — Said to be from Hong Kong (erroneous).

Material examined. — **South Africa**. *"Meiring Naudé"*: stn SM 184, 33°39' S, 27°12' E, 86 m, 1 dd. — Stn SM 185, 33°39' S, 27°11' E, 90 m, 1 dd (SAM).

Fig. 63. — Distribution of *Schizodentalium plurifissuratum*.

Distribution. — Apparently endemic to South Africa and Agulhas Bank (Sowerby, 1903). No information on living depth range; shells from 86 m (present paper) to 564 m (Barnard, 1963b).

Genus *Compressidentalium* Habe, 1963

Type species (OD): *Dentalium hungerfordi* Pilsbry & Sharp, 1897.

Diagnosis. — *Shell* medium to large, slightly curved to almost straight, usually curved only at apical portion. Solid, polished, white to red. Longitudinal sculpture of more than 14 strong primary ribs; secondary ribs present, reaching the oral area. Rib section flat at top, round, smooth. Intercostal spaces concave, smooth or with longitudinal striae. Apex with flat, V-shaped notch on ventral side, apical callus with terminal pipe or irregular slit. Section strongly compressed dorsoventrally. Oral aperture oval or subtriangular.
Radula similar to that of *Antalis*.

Source : MNHN, Paris

DISTRIBUTION. — Pacific and Indian Oceans. Absent in the Atlantic Ocean. Temperate-tropical, shelf to abyssal.

Compressidentalium hungerfordi (Pilsbry & Sharp, 1897)

Figs 64, 70 g

Dentalium hungerfordi Pilsbry & Sharp, 1897: 84, pl. 6, fig. 86 (*nom. nov. pro Deutalium compressum* Sowerby, 1888: 569, pl. 28, fig. 18, *non* Watson, 1879).

Other references:

Dentalium (*Fissidentalium*) *hungerfordi* — BOISSEVAIN, 1906: 38, pl. 2, fig. 30. — HIRASE, 1931: 293, figs 749-750. — KIRA, 1955: 80, pl. 40, fig. 10.
Fissidentalium (*Compressidentalium*) *hungerfordi* — HABE, 1963: 260, pl. 37, fig. 14, textfigs 25-26; 1964a: 17, pl. 1, fig. 14, pl. 4, figs 25-26; 1971: 487 (Japanese text), 306 (English text), pl. 65, figs 2-3. — HABE, 1977: 332. — HIGO & GOTO, 1993: 686.

TYPE MATERIAL. — Holotype BMNH 1881.2.1.1.

TYPE LOCALITY. — Hong Kong.

MATERIAL EXAMINED. — **Japan**. Tosa Bay, Shikoku, 100 fms [183 m], Coll. STAADT, 1 dd (MNHN).

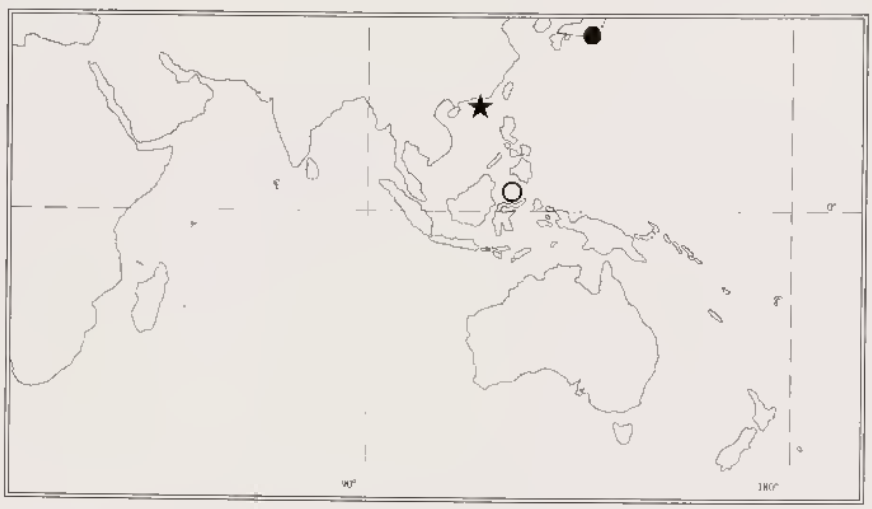


FIG. 64. — Distribution of *Compressidentalium hungerfordi*.

DISTRIBUTION. — Indonesia, China, Japan, 50-1570 m.

Compressidentalium compressiusculum (Boissevain, 1906)

Figs 65, 70 h, 73 h

Dentalium compressiusculum Boissevain, 1906: 33, pl. 6, fig. 12.

Other reference:

Fissidentalium (*Compressidentalium*) *compressiusculum* — HABE & KOSUGE, 1964: 4.

Source : MNHN, Paris

TYPE MATERIAL. — Holotype ZMA 3.06.044.

TYPE LOCALITY. — *"Siboga"*, stn 241, 04°24′ S, 129°49′ E, 1570 m, Banda Sea.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. CORAIL 2: stn DW 172, 18°26′ S, 155°12′ E, 1100 m, 5 dd.
New Caledonia. BIOCAL: stn KG 95, 21°22′ S, 166°33′ E, 2365 m, 1 dd.
BIOGEOCAL: stn KG 248, 21°15′ S, 166°29′ E, 2340 m, 1 dd. — Stn DW 296, 20°38′ S, 167°10′ E, 1230-1270 m, 4 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 468, 21°06′ S, 167°33′ E, 600 m, 1 dd.
Indonesia. CORINDON: stn DR 231, 00°05′ N, 119°48′ E, 1080 m, 1 lv.
"Galathea": stn 490, 05°25′ S, 117°03′ E, 585 m, 2 dd (ZMC).
Philippines. MUSORSTOM 2: stn CP 50, 13°37′ N, 120°34′ E, 810-820 m, 2 lv. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 12 lv, 28 dd. — Stn CP 79, 13°44′ N, 120°32′ E, 682-770 m, 1 dd. — Stn CP 81, 13°34′ N, 120°31′ E, 856-884 m, 2 lv.
MUSORSTOM 3: stn DR 93, 13°49′ N, 120°02′ E, 540 m, 8 lv, 12 dd. — Stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 5 lv, 25 dd.
ESTASE 2: stn CP 6, 04°38′ N, 119°49′ E, 2570 m, 4 lv, 1 dd.
West Indian Ocean. BENTHEDI: stn DS 64, 12°41′ S, 44°57′ E, 860-770 m, 1 dd.
MD 32 Réunion: stn DC 18, 21°19′ S, 55°16′ E, 3150-3225 m, 1 dd. — Stn DR 104, 20°49′ S, 55°01′ E, 1875-1920 m, 4 dd. — Stn DR 106, 20°48′ S, 55°05′ E, 1710-1730 m, 2 dd.

FIG. 65. — Distribution of *Compressidentalium compressiusculum*.

DISTRIBUTION. — Indonesia, now extended to the Philippines, New Caledonia and the Western Indian Ocean; live records from 540 to 2570 m, mostly between 540 and 700 m (present paper).

Compressidentalium sedecimcostatum (Boissevain, 1906)

Figs 66, 70 j

Dentalium sedecimcostatum Boissevain, 1906: 33, pl. 6, figs 8-11.

Other references:

Dentalium sedecimcostatum — PLATE, 1908: 347.
Fissidentalium (Compressidentaliun?) sedecimcostatum — HABE & KOSUGE, 1964: 4.
Striodentalium sedecimcostatum — QI & MA, 1989: 118, figs 10a-b.

Source : MNHN, Paris

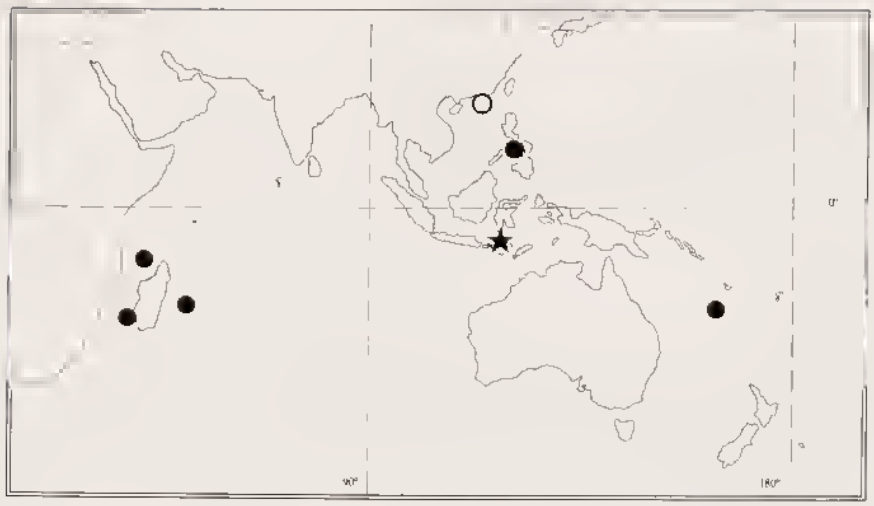


FIG. 66. — Distribution of *Compressidentalium sedecimcostatum*.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.035, paralectotypes ZMA 3.06.036-043.

TYPE LOCALITY. — *"Siboga"*, stn 52, 09°03′ S, 119°57′ E, 959 m, Banda Sea.

MATERIAL EXAMINED. — The type material.

Chesterfield Islands. MUSORSTOM 5: stn DC 321, 21°20′ S, 158°02′ E, 1000 m, 2 dd. — Stn CP 324, 21°15′ S, 157°51′ E, 970 m, 1 lv.

New Caledonia. *"Vauban"* 1978-79: stn 32, 22°32′ S, 166°25′ E, 430-500 m, 1 lv. — Stn 33, 22°33′ S, 166°25′ E, 290-350 m, 2 lv, 7 dd. — Stn 34, 22°32′ S, 166°26′ E, 350-420 m, 2 lv, 6 dd. — Stn 35, 22°32′ S, 166°26′ E, 250-375 m, 1 dd. — Stn 39, 22°29′ S, 166°23′ E, 375-550 m, 1 dd. — Stn 40, 22°30′ S, 166°24′ E, 250-350 m, 8 lv, 47 dd.

BIOCAL: stn CP 29, 23°08′ S, 166°40′ E, 1100 m, 1 dd. — Stn CP 30, 23°09′ S, 166°41′ E, 1140 m, 1 dd. — Stn CP 55, 23°20′ S, 167°30′ E, 1160-1175 m, 1 lv, 3 dd. — Stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 2 lv, 4 dd. — Stn CP 69, 23°52′ S, 167°58′ E, 1220-1225 m, 1 dd. — Stn DW 104, 21°31′ S, 166°21′ E, 375-450 m, 3 dd.

LAGON: stn 872, 20°37′ S, 165°58′ E, 105 m, 1 dd.

Passe de Boulari, B. Richer/ORSTOM coll., 400 m, 2 lv, 7 dd.

BIOGEOCAL: stn KG 219, 22°39′ S, 166°34′ E, 570 m, 1 dd. — Stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 2 dd. — Stn CP 238, 21°28′ S, 166°23′ E, 1260-1300 m, 4 dd. — Stn CP 273, 21°02′ S, 166°57′ E, 1920-2040 m, 2 lv, 1 dd. — Stn DW 313, 20°59′ S, 166°59′ E, 1600-1640 m, 2 dd.

MUSORSTOM 4: stn DC 168, 18°48′ S, 163°11′ E, 720 m, 1 dd. — Stn DW 220, 22°58′ S, 167°38′ E, 505-550 m, 1 lv. — Stn CP 242, 22°06′ S, 167°10′ E, 500-550 m, 1 lv.

Loyalty Islands. MUSORSTOM 6: stn DW 394, 20°49′ S, 167°09′ E, 570 m, 3 lv, 6 dd. — Stn DW 424, 20°24′ S, 166°25′ E, 599 m, 1 lv, 1 dd. — Stn DW 425, 20°24′ S, 166°25′ E, 594 m, 4 dd. — Stn DW 468, 21°06′ S, 167°33′ E, 600 m, 1 dd. — Stn DW 483, 21°20′ S, 167°48′ E, 600 m, 1 lv, 1 dd.

Philippines. ESTASE 2: stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 1 lv.

MUSORSTOM 3: stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 3 lv, 1 dd.

West Indian Ocean. BENTHEDI: stn DR 33, 12°54′ S, 45°16′ E, 275-400 m, 3 lv, 14 dd. — Stn DR 38, 12°55′ S, 45°16′ E, 200-500 m, 7 lv, 6 dd. — Stn DS 42, 13°05′ S, 45°08′ E, 400-520 m, 3 lv. — Stn F 61, 12°46′ S, 44°58′ E, 475-510 m, 2 lv, 7 dd. — Stn DS 62, 12°46′ S, 44°58′ E, 530-535 m, 1 dd.

MD 32 Réunion: stn DC 10, 21°13′ S, 55°52′ E, 930-980 m, 2 dd. — Stn DC 58, 21°03′ S, 55°10′ E, 450 m, 5 lv, 14 dd. — Stn DC 64, 21°12′ S, 55°04′ E, 1150-1180 m, 1 lv, 3 dd. — Stn DC 112, 20°53′ S, 55°09′ E, 740-780 m, 1 dd. — Stn DS 178, 21°04′ S, 55°10′ E, 412-460 m, 4 lv, 2 dd.

"Mascareignes III": R. von Cosel coll. 1986: stn 97, 22°24′ S, 43°04′ E, 600 m, 1 dd.

Source : MNHN, Paris

DISTRIBUTION. — Indonesia, East China Seas, 550 m (QI & MA, 1989) to East Africa, 1143 m (PLATE, 1908). Now extended to New Caledonia; live records from 250 to 2050 m (present paper).

Compressidentalium subcurvatum (Smith, 1906)

Figs 62 e, k, 67, 71 g

Dentalium subcurvatum Smith, 1906a [October]: 251.

Synonym:

Dentalium martensi Boissevain, 1906 [December]: 34, pl. 4, fig. 19 (**Syn. nov.**).

Other references:

Dentalium subcurvatum – ANNANDALE & STEWART, 1909: pl. 23, fig. 3. — WINCKWORTH, 1940a: 25.
Dentalium martensi – LUDBROOK, 1954: 93.
Fissidentalium martensi – KOSUGE, 1985: 59, pl. 23, fig. 4.

TYPE MATERIAL. — *D. subcurvatum*: holotype BMNH. — *D. martensi*: lectotype (here designated) ZMA 3.06.045, paralectotypes ZMA 3.06.046.047.

TYPE LOCALITY. — *D. subcurvatum*: Indian Ocean, SW Cape Comorin, *"Investigator"* stn 275, 08°27′ N, 75°35′ E, 731-771 fms [1336-1409 m]. — *D. martensi*: Indonesia, *"Siboga"*, stn 88, 00°35′ N, 119°09′ E, 1301 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. MUSORSTOM 4: stn DC 168, 18°48′ S, 163°11′ E, 720 m, 1 lv.
Indonesia. CORINDON: stn DR 231, 00°05′ N, 119°48′ E, 980-1080 m, 1 lv.
"Snellius" II: stn 4.164, 06°24′ S, 120°21′ E (no depth data), 5 dd (RMNH).
Philippines. MUSORSTOM 1: stn CP 47, 13°41′ N, 120°30′ E, 685-757 m, 1 dd.
MUSORSTOM 2: stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 91 lv, 181 dd. — Stn CP 55, 13°54′ N, 119°59′ E, 865-866 m, 10 lv, 12 dd. — Stn CP 81, 13°34′ N, 121°31′ E, 856-884 m, 4 lv, 3 dd.
MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd. — Stn DR 95, 13°56′ N, 119°59′ E, 865 m, 2 lv, 11 dd. — Stn CP 114, 13°34′ N, 120°29′ E, 1000-1040 m, 1 lv.
West Indian Ocean. NW Madagascar, Crosnier coll. 1975: stn CH 142, 13°46′ S, 47°34′ E, 1250-1300 m, 5 dd.

FIG. 67. — Distribution of *Compressidentalium subcurvatum*.

Source : MNHN, Paris

DISTRIBUTION. — Indian Ocean and Indonesia, now extended to the Philippines and New Caledonia; live records from 685 to 1090 m (present paper) and shells from 142 to 1411 m.

REMARKS. — *Fissidentalium clathratum* Martens, 1881, from Northeastern Australia, could be a senior synonym of *C. subcurvatum*, but until type material of that species is examined, it appears best to consider *C. subcurvatum* the valid name of the present species.

Compressidentalium zanzibarense (Plate, 1908)

Figs 68, 70 i

Dentalium zanzibarense Plate, 1908a: 384, pl. 3, figs 35-36.

Other reference:
Dentalium zanzibarense – LUDBROOK, 1954: 93.

TYPE MATERIAL. — Holotype ZMB 61092 (*fide* KILIAS, 1995).

TYPE LOCALITY. — *"Valdivia"*, stn 245, 05°28′ S, 39°18′ E, 463 m, Zanzibar Channel.

MATERIAL EXAMINED. — **West Indian Ocean.** BENTHEDI: stn DR 40, 12°56′ S, 45°18′ E, 1300-1480 m, 1 lv, 1 dd.
MD32 Réunion: stn CP 105, 20°47′ S, 55°04′ E, 1740-1850 m, 9 lv, 14 dd. — Stn DS 106, 20°48′ S, 55°05′ E, 1710-1730 m, 1 lv. — Stn DC 138, 24°41′ S, 55°36′ E, 1500-1590 m, 4 dd.
"Meiring Naudé": stn SM 53, 26°51′ S, 33°13′ E, 720 m, 1 dd. — Stn SM 78, 27°32′ S, 32°50′ E, 750 m, 1 lv, 3 dd. — Stn SM 86, 28°00′ S, 32°41′ E, 550 m, 1 dd. — Stn SM 94, 28°16′ S, 32°39′ E, 670 m, 1 dd. — Stn SM 117, 30°18′ S, 31°10′ E, 820 m, 3 dd. — Stn SM 121, 30°32′ S, 30°53′ E, 625-900 m, 1 dd. — Stn SM 123, 30°33′ S, 30°49′ E, 690 m, 1 lv. — Stn SM 129, 30°53′ S, 30°31′ E, 850 m, 1 dd. — Stn SM 131, 30°43′ S, 30°42′ E, 780 m, 8 dd. — Stn SM 226, 32°29′ S, 28°59′ E, 710-775 m, 36 dd. — Stn SM 232, 32°15′ S, 29°10′ E, 260-620 m, 1 dd.

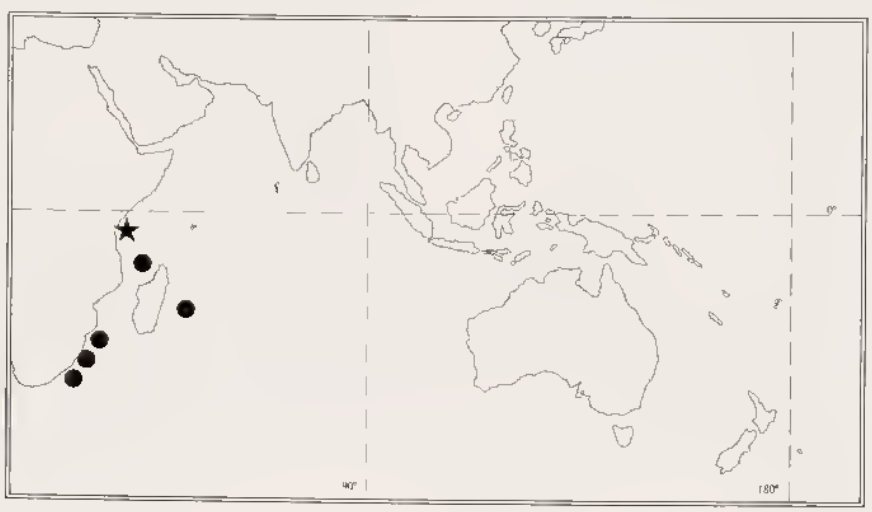


FIG. 68. — Distribution of *Compressidentalium zanzibarense*.

DISTRIBUTION. — Off Zanzibar, now extended to Madagascar, Réunion Island and South Africa, recorded alive from 690 to 1850 m.

Source : MNHN, Paris

Compressidentalium ceciliae sp. nov.

Figs 69, 70 k, 71 i

TYPE MATERIAL. — Holotype MNHN. Paratypes: 11 MNHN, 1 AMS C201725, 1 NMNZ M268958, 1 USNM.

TYPE LOCALITY. — Southern New Caledonia, MUSORSTOM 4, stn DW 220, 22°58′ S, 167°38′ S, 505-550 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 220, 22°58′ S, 167°38′ S, 505-550 m, 9 lv (holotype and paratypes: 7 MNHN, 1 NMNZ).
BIOCAL: stn DW 08, 20°34′ S, 166°54′ E, 435 m, 4 dd. — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 2 lv, 6 dd. — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 13 lv (paratypes: 4 MNHN, 1 AMS), 21 dd (1 paratype USNM).

FIG. 69. — Distribution of *Compressidentalium ceciliae*.

DISTRIBUTION. — E and SE New Caledonia, living in 505-700 m.

DESCRIPTION. — *Shell* to 36 mm long, solid, polished, white, straight for the anterior three fourths, then curved at posterior end. Section subcircular at apex, strongly compressed dorsoventrally otherwise. Sculpture consists of 15 smooth prominent, primary ribs, more polished than the interspaces. Two lateral ribs noticeably more prominent are present on some specimens. Secondary ribs originate on the posterior 1/3 of the shell, becoming as prominent as the primary ribs at the anterior end. Mouth oval, more compressed on ventral side. Apex narrow with V-shaped notch on ventral side.

Measurements: holotype L 34.7, W 3.6-3, w 0.5, arc 1 (in the curved part); paratypes L 34, W 3.6-3, w 0.8, arc 0.8; L 31.9, W 3.4-2.9, w 0.7, arc 0.7; L 35.5, W 3.7-3.2, w 0.7, arc 1; L 29, W 3.6-3.1, w 0.9, arc 1.1; L 27.1, W 3.3-3, w 0.7, arc 0.9; L 15.7, W 2.3-2, w 0.7, arc 0.5. W/w ratio 7.2-3.2.

ETYMOLOGY. — Named for the author' s wife, Cecilia VALDÉS.

Other Indo-Pacific species of *Compressidentalium* cited in the literature

Compressidentalium clathratum (Martens, 1881): 66. Off Moreton Bay, NE Australia, *"Gazelle"*, 1005 m. Holotype ZMB 33122 (*fide* KILIAS, 1995).

Source : MNHN, Paris

Compressidentalium lardum (Barnard, 1963a): 445. Off South Africa, 33°26' S, 16°33' E, 2267-2376 m. SAM and paratype BMNH 1964.2.42.
Compressidentalium sibogae (Boissevain, 1906): 39, pl. 4, figs 17-18, textfig. 22. Indonesia, *"Siboga"*, stn 159, 00°59' S, 129°49' E, 411 m. ZMA.
Compressidentalium sumatrense (Jaeckel, 1932): 304, textfig. 3. Indonesia, Sumatra, *"Valdivia"*, stn 191, 00°39' S, 98°52' E, 750 m. Holotype ZMB 61081.

Genus *Coccodentalium* Sacco, 1896

Type species (OD): *Dentalium radula* Schröter, 1784. Miocene, Italy.

DIAGNOSIS. — *Shell* medium in length, nearly straight, solid, polished, white, usually with dark brown markings. Longitudinal sculpture of 6 primary ribs, secondary ribs reaching oral area. Rib section round, irregular due to nodules, cancellate throughout. Intercostal spaces concave, transversally sculptured. Apex with flat V-shaped notch on ventral side, lumen circular. Section polygonal at apex, subpolygonal at aperture.
Radula rachidian with anterior border irregular and granulose; lateral similar to *Dentalium*, smooth; marginal sigmoidal.

DISTRIBUTION. — Eocene-Recent, Pacific and Indian Oceans, shelf to bathyal.

Coccodentalium gemmiparum (Melvill, 1909)

Figs 70 l-m, 72, 73 e-f

Dentalium gemmiparum Melvill, 1909: 120, pl. 5, fig. 10.

TYPE MATERIAL. — Holotype BMNH 1910.3.17.5.

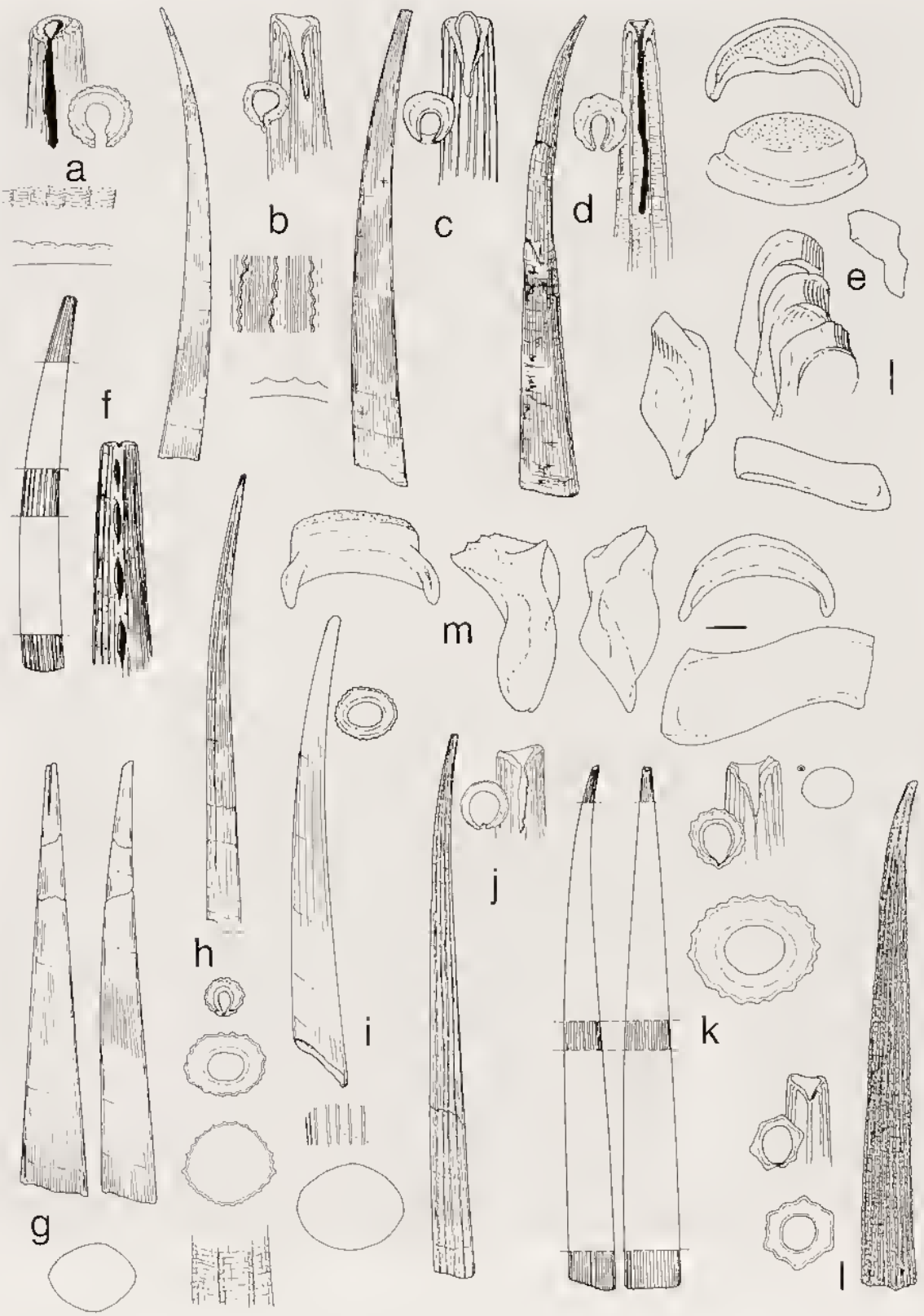
TYPE LOCALITY. — Indian Ocean, Chagos Archipelago, Diego Garc°a Lagoon.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOGEOCAL: stn CP 278, 22°48' S, 166°20' E, 2250 m, 1 dd.
Philippines. MUSORSTOM 3: stn DR 126, 11°49' N, 121°22' E, 266 m, 2 dd. — Stn CP 139, 11°53' N, 122°14' E, 240-267 m, 153 lv, 96 dd.

DISTRIBUTION. — Chagos Archipelago, now extended to the Philippines and New Caledonia, alive in 240-267 m (present paper), shell (probably washed down) in 2250 m.

FIG. 70. — **a**, *Fissidentalium profundorum*, apex and apical section, detail of sculpture, section of ribs, BIOGEOCAL: stn CP 238. — **b**, *Fissidentalium serrulatum*, shell (65 mm), apex and apical section, detail of sculpture, section of ribs, CORINDON: stn DR 216. — **c**, *Fissidentalium levii* sp. nov., holotype, shell (51.7 mm), apex and apical section. — **d**, *Fissidentalium metivieri* sp. nov. (paratype), shell (154 mm), apex and apical section. — **e**, *Fissidentalium metivieri* sp. nov., radula; rachidian, external and internal face, transversal and sagittal section; laterals, posterior view; marginal contact area with laterals at left. — **f**, *Schizodentalium plurifissuratum*, shell (45 mm), apex. — **g**, *Compressidentalium hungerfordi*, shell (85 mm), ventral and lateral views, oral section, Japan (MNHN). — **h**, *Compressidentalium compressiusculum*, shell (60 mm), apical, posterior 1/4, and anterior1/4 sections (note the two latero-ventral more prominent ribs), detail of the sculpture, ESTASE 2: stn CP 6. — **i**, *Compressidentalium zanzibarense*, shell (32 mm), apical and oral sections, detail of the sculpture, *"Meiring Naudé"*: stn 131 . — **j**, *Compressidentalium sericimcostatum*, shell (52 mm), apex and apical section, *"Vauban"* 1978-79: stn 34. — **k**, *Compressidentalium ceciliae* sp. nov., holotype, shell (34.7 mm), lateral and dorsal views, apex, apical, medial and oral sections. — **l**, *Coccodentalium gemmiparum*, shell (37 mm), apex, apical sections, MUSORSTOM 3: stn CP 139. — **m**, *Coccodentalium* type radula (*C. gemmiparum*). Scale line: 100 µm.

Source : MNHN, Paris



Source : MNHN, Paris

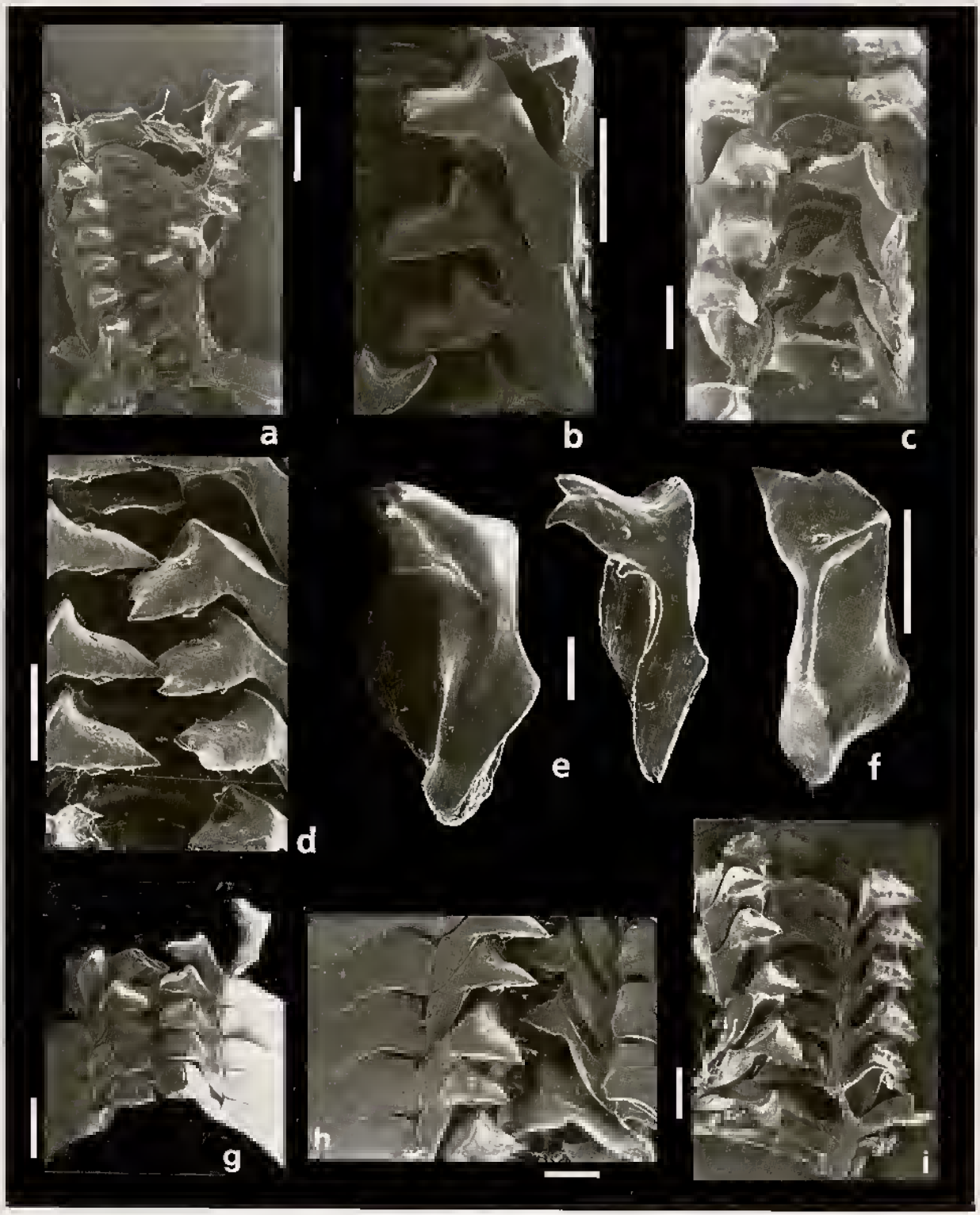


FIG. 71. — Radulae. — **a**, *Dentalium deforgesi*, general view, note the tooth of the right column in different positions. — **b**, same specimen, detail of laterals. — **c**, *Dentalium caledonicum*, general view. — **d**, *Dentalium oryx*, view of the heads of laterals. — **e**, *Fustiaria langfordi*, detail of laterals. — **f**, *Graptacme lactea*, external face of a lateral tooth. — **g**, *Compressidentalium subcurvatum*, general view. — **h**, *Fustiaria vagina*, general view. — **i**, *Compressidentalium ceciliae*, general view. Scale bars: 200 µm (a, c, e), 100 µm (b, d, f, h, i), 500 µm (g).

Source : MNHN, Paris

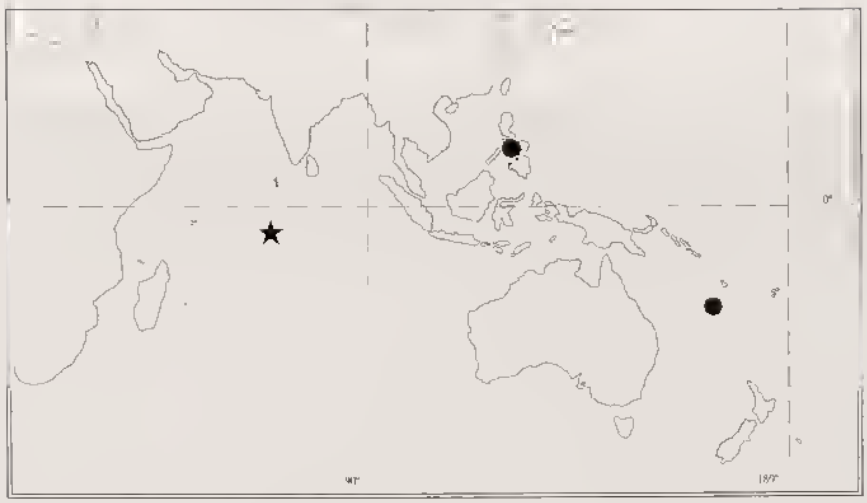


FIG. 72. — Distribution of *Coccodentalium gemmiparum*.

Genus *PICTODENTALIUM* Palmer, 1974

Type species (OD): *Dentalium hirasei* Kira, 1959.

DIAGNOSIS. — *Shell* medium to very large, slightly to well curved, solid, polished, light yellow to brightly coloured with red, violet and green patches. Longitudinal sculpture of wide primary ribs and secondary ribs reaching the oral area. Rib section flat-topped to rounded. Intercostal spaces, straight or concave, smooth or longitudinally sculptured. Apex with terminal callus and flat V-shaped notch on ventral side; fissured terminal pipe. Section circular to slightly compressed dorsoventrally. Oral aperture usually thin and coloured.
Radula rachidian flat, curved, anterior margin very slightly granulose; lateral with prominent primary cusp and sculptured head; marginal slightly curved.

DISTRIBUTION. — Recent, Pacific and Indian Oceans, absent in the Atlantic Ocean, sublittoral to bathyal.

REMARKS. — *Pictodentalium* was invalidly introduced by KIRA (1959), who is generally cited as author of this name. However, I refer to the discussion by BIELER & PETIT (1990), who credit authorship of *Pictodentalium* to PALMER (1974).

Pictodentalium formosum (Adams & Reeve, 1848)

Figs 74, 77 b

Dentalium formosum Adams & Reeve, 1848: 71, pl. 5, figs 1a-b.

Synonyms:

Pictodentalium formosum hirasei Kira, 1959: 117, pl. 41, fig. 11.
Fissidentalium formosum harrisoni Habe, 1970: 95.

Other references:

Dentalium formosum – SOWERBY, 1860: 102, pl. 223 (*Dentalium* 1), fig. 2; 1873: pl. 2, fig. 7. — CLESSIN, 1896: 21, pl. 6, fig. 7. — PILSBRY & SHARP, 1897: 2, pl. 1, figs 9-11. — BOISSEVAIN, 1906: 8, pl. 1, fig. 2. — KIRA, 1955: 80, pl. 40, fig. 11.
Dentalium (Dentalium) formosum – HIRASE, 1931: 135, pl. 3, fig. 3.
Pictodentalium formosum – HABE, 1977: 332.

Source : MNHN, Paris

FIG. 73. — **a-d** *Fissidentalium shoplandi* (153 mm), MUSORSTOM 3: stn CP 128. — **b-c**, details of the sculpture. — **d**, *Fissidentalium shoplandi*, holotype (71 mm). — **e-f**, *Coccodentalium gemmiparum*, details of sculpture. — **g**, *Antalis boucheti*, detail of the sculpture. — **h**, *Compressidentalium compressiusculum*, detail of the sculpture. — **i**, *Graptacme lactea*, apex and sculpture. Scale bars: 100 µm (b, e, g, h, i), 10 µm (c, f).

Source : MNHN, Paris

Pictodentalium formosum hirasei – Okutani, 1983: 12, pl. 43, fig. 12.
Fissidentalium (Pictodentalium) formosum – Habe, 1963: 255, pl. 37, figs 4, 12, textfig. 22. — Habe & Kosuge, 1964: 4; 1977: 332. — Habe & Kosuge, 1966: 117, figs 22-23. — Springsteen & Leobrera, 1985: 286, pl. 82, fig. 5. — Higo & Goto, 1993: 686.
Fissidentalium formosum – Qi & Ma, 1989: 116, figs 6a-b.
Fissidentalium formosum harrisoni – Higo & Goto, 1993: 686.

Type material. — *D. formosum*: 3 syntypes dd BMNH 1951.2.14.1-3. — *P. f. hirasei*: not checked. — *F. f. harrisoni*: NSMT 37303 (*fide* Habe, 1970) [not seen].

Type locality. — *D. formosum*: Sulu Archipelago, 29-36 m. — *P. f. hirasei*: Southern Japan, 20 fms [37 m]. — *F. f. harrisoni*: South China Sea.

Material examined. — The type material of *D. formosum*.
China. South China Sea, Coll. Staadt, 1 dd (MNHN).

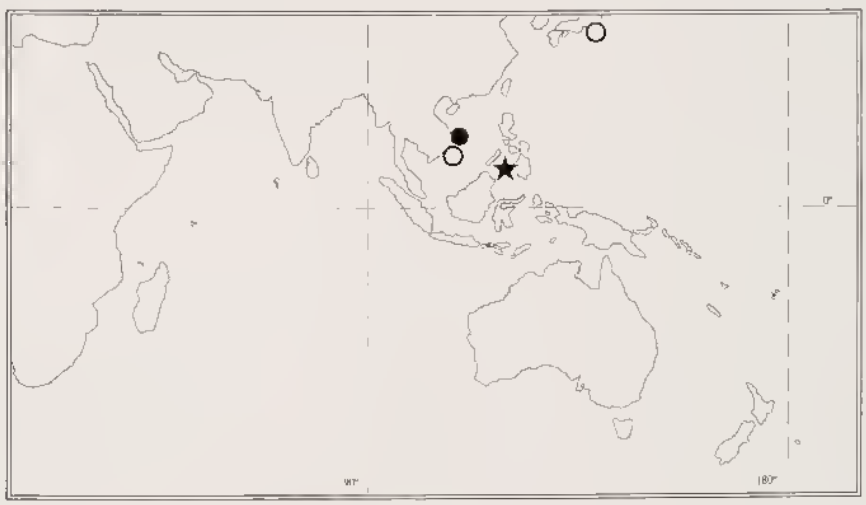


Fig. 74. — Distribution of *Pictodentalium formosum*.

Distribution. — Japan, 0-50 m (Habe & Kosuge, 1964), South China Sea, 77-145 m (Qi & Ma, 1989), the Philippines (Springsteen & Leobrera, 1985).

Pictodentalium festivum (Sowerby, 1914)

Figs 62 g, 75, 77 c, 78 b

Dentalium festivum Sowerby, 1914: 8, textfig.

Other reference:
Dentalium festivum – Habe, 1963: 255 (as synonym of *P. formosum*).

Type material. — Holotype BMNH 1914.4.21.

Type locality. — New Caledonia.

Material examined. — The holotype.
Chesterfield Islands. CHALCAL 1: stn DC 6, 20°57′ S, 161°43′ E, 45 m, 1 dd. — Stn DC 26, 19°11′ S, 158°35′ E, 48 m, 2 dd. — Stn DC 37, 19°54′ S, 158°46′ E, 50 m, 2 dd. — Stn DC 45, 20°50′ S,

Source : MNHN, Paris

158°30′ E, 50 m, 1 dd. — Stn DC 50, 21°04′ S, 158°41′ E, 70 m, 1 dd. — Stn DC 56, 21°24′ S, 159°09′ E, 60 m, 1 lv. — Stn DC 59, 21°40′ S, 159°21′ E, 56 m, 1 dd.
MUSORSTOM 5: stn DW 264, 25°20′ S, 159°44′ E, 56 m, 1 lv, 2 dd.
CORAIL 2: stn DW 71, 19°15′ S, 158°24′ E, 55 m, 1 lv. — Stn DW 91, 19°03′ S, 158°55′ E, 43 m, 1 lv. — Stn DW 103, 19°01′ S, 158°32′ E, 58 m, 1 dd. — Stn DW 117, 19°25′ S, 158°32′ E, 52 m, 1 dd. — Stn DW 136, 19°31′ S, 158°16′ E, 37 m, 2 dd.
New Caledonia. LAGON: stn 120, 22°28′ S, 166°44′ E, 46 m, 1 dd. — Stn 129, 22°31′ S, 166°47′ E, 44-46 m, 2 lv, 3 dd. — Stn 151, 22°32′ S, 166°48′ E, 31-33 m, 1 lv. — Stn 229, 22°39′ S, 166°40′ E, 41 m, 1 dd. — Stn 230, 22°38′ S, 166°41′ E, 35 m, 1 lv. — Stn 234bis, 22°32′ S, 166°51′ E, 60 m, 1 dd. — Stn 241, 22°21′ S, 167°00′ E, 35 m, 2 lv. — Stn 313, 22°40′ S, 166°50′ E, 30 m, 1 lv. — Stn 326, 22°26′ S, 167°02′ E, 67 m, 1 dd. — Stn 345, 22°46′ S, 166°50′ E, 39 m, 1 dd. — Stn 358, 22°31′ S, 167°05′ E, 50 m, 1 dd. — Stn 362, 22°38′ S, 167°00′ E, 83 m, 1 dd. — Stn 373, 22°28′ S, 167°11′ E, 52-57 m, 2 dd. — Stn 376, 22°34′ S, 167°06′ E, 75-76 m, 1 dd. — Stn 377, 22°35′ S, 167°08′ E, 56 m, 1 dd. — Stn 382, 22°30′ S, 167°14′ E, 57 m, 1 dd. — Stn 383, 22°32′ S, 167°13′ E, 62 m, 1 lv, 2 dd. — Stn 403, 22°35′ S, 167°18′ E, 45 m, 2 dd. — Stn 414, 22°37′ S, 167°16′ E, 60 m, 1 dd. — Stn 416, 22°38′ S, 167°14′ E, 40-50 m, 1 lv. — Stn 474, 18°02′ S, 163°02′ E, 52 m, 1 lv. — Stn 542, 19°06′ S, 163°10′ E, 50 m, 2 dd. — Stn 603, 22°16′ S, 167°05′ E, 78-80 m, 2 dd. — Stn 607, 22°12′ S, 167°03′ E, 48-54 m, 1 dd. — Stn 619, 22°03′ S, 166°54′ E, 27-42 m, 1 dd. — Stn 729, 21°19′ S, 165°54′ E, 42-45 m, 2 dd. — Stn 858, 20°37′ S, 165°07′ E, 220 m, 2 dd. — Stn 888, 20°22′ S, 164°38′ E, 20 m, 2 lv.
MUSORSTOM 4: stn DW 231, 22°34′ S, 167°10′ E, 75 m, 1 dd.
"Vauban" 1978-79: stn 10, 22°17′ S, 167°05′ E, 80 m, 1 dd.
Ilôt Maître, 20 m, Estival coll. 1980, 2 dd (MNHN).

FIG. 75. — Distribution of *Pictodentalium festivum*.

DISTRIBUTION. — New Caledonia, alive in 20-62 m (present paper).

REMARKS. — HABE (1964) considered *Pictodentalium festivum* a junior synonym of *P. formosum* but examination of the type material and other specimens of both species allows me to reestablish Sowerby's species. *P. festivum* has more ribs (17-19), is angled in section, and the material examined always presented secondary ribs. The ribs of *P. formosum* are wide and round in section, fewer in number (13-17) and have no secondary ribs. Also the color pattern is different, *P. formosum* is basically dark purple with rose and green patches, while *P. festivum* is light purple, rose and cream.

Source : MNHN, Paris

Pictodentalium vernedei (Sowerby, 1860)

Figs 76, 77 a

Dentalium vernedei Sowerby, 1860: 101, pl. 223 (*Dentalium* 1), fig. 3.

Other references:

Dentalium vernedei – Pilsbry & Sharp, 1897: 80, pl. 3, figs 35, 43. — Sowerby, 1873: pl. 1, fig. 3.
Dentalium (*Fissidentalium*) *vernedei* – Hirase, 1931: 137, pl. 3, fig. 8. — Habe, 1953: 293, figs 741-743; 1963: 258, pl. 37, fig. 9, textfigs 30-31.
Fissidentalium vernedei – Kira, 1962: 117, pl. 41, fig. 13.
Fissidentalium (*Pictodentalium*) *vernedei* – Habe, 1964a: 16, pl. 1, fig. 9, pl. 4, figs 30-31. — Habe & Kosuge, 1964: 3. — Habe, 1977: 332. — Ieyama 1993: 246, figs 4-5. — Higo & Goto, 1993: 686.

Type material. — BMNH (not seen).

Type locality. — Japan.

Material examined. — **China**. No further data, Coll. Jousseaume, 1 dd. — Coll. Denis, 3 dd (both MNHN).
Japan. No other data, Coll. Staadt, 3 dd (MNHN).

Fig. 76. — Distribution of *Pictodentalium vernedei*.

Distribution. — China and Japan, 20-100 m.

Family Calliodentaliidae Chistikov, 1975

Genus *Calliodentalium* Habe, 1964

Type species (OD): *Dentalium crocinum* Dall, 1907.

Diagnosis. — *Shell* medium to large, well curved, thin but not fragile, polished, shiny, white, yellow or orange. Smooth or sculptured only at apical portion by longitudinal striae or close, fine, encircled wrinkles. Apex simple or with flat V-shaped notch on ventral side. Section subcircular, slightly compressed dorsoventrally, more noticeable on ventral side.

Source : MNHN, Paris

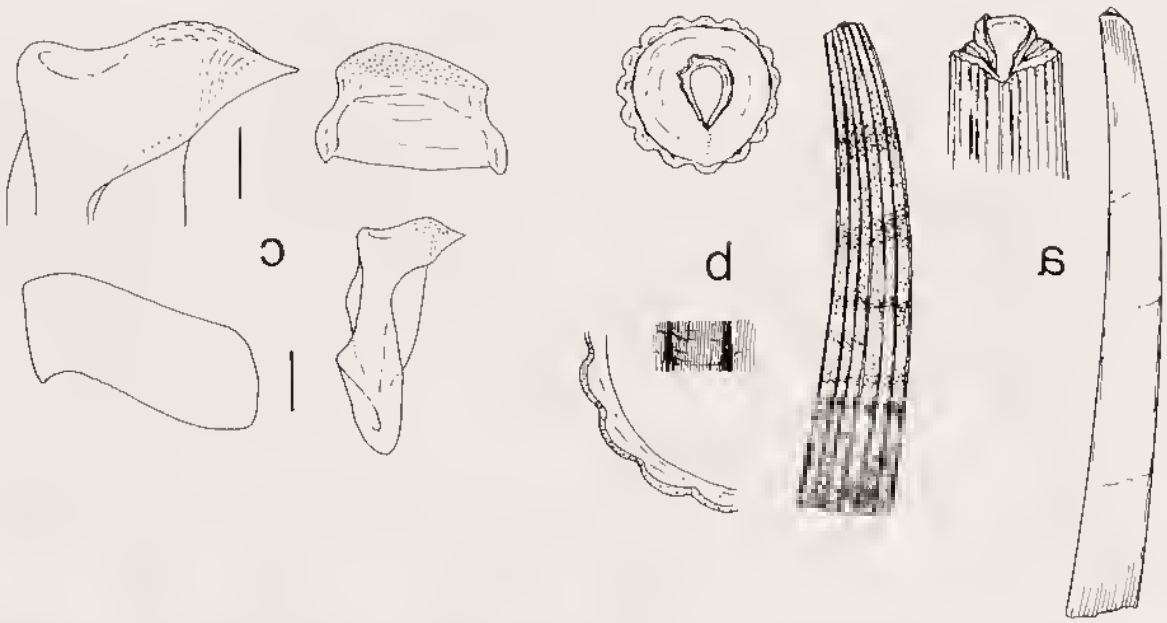


FIG. 77. — a, *Pictodentalium vernedei*, shell (119 mm), apex, Japan (MNHN). — b, *Pictodentalium formosum*, shell (53 mm), apical and oral sections, detail of the sculpture, South China Sea (MNHN). — c, *Pictodentalium* type radula (*P. festivum*); see also Fig. 78 b.

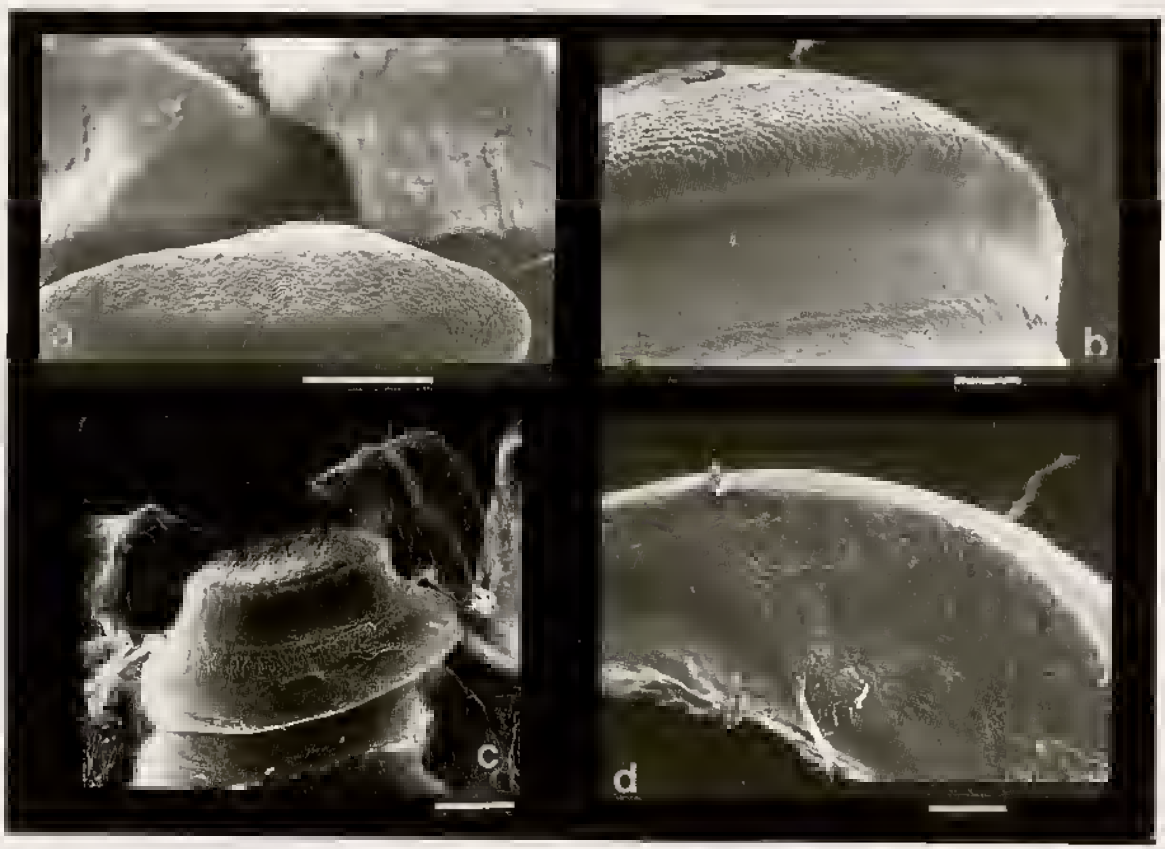


FIG. 78. — Radulae. — **a**, *Fissidentalium magnificum*, rachidian, anterior border. — **b**, *Pictodentalium festivum*, rachidian, detail of the external face. — **c**, *Fissidentalium candidum* (North Atlantic Ocean), rachidian, external face. — **d**, *Fustiaria caesura*, rachidian, anterior border. Scale bars: 100 µm (a), 200 µm (c), 20 µm (b, d).

Source : MNHN, Paris

Radula rachidian slightly curved, anterior margin irregular, smooth; subrachidians (see below) subpyramidal; laterals with the head slightly differenciated from body, one primary cusp almost central and one secondary cusp sharp, another one with low cusp; marginals almost straight.

DISTRIBUTION. — Recent, worldwide, temperate and warm waters, shelf to bathyal.

REMARKS. — This genus presently contains four species: *C. callipeplum* (Dall, 1889) from the Western Atlantic Ocean and Caribbean Sea, *C. crocinum*, *C. semitracheatum*, and *C. balanoides* from the Indo-Pacific. The unique radular formula (1-1-1r-1-1r-1-1) is characteristic, with an accessory structure which I name subrachidian. Though considered by SCARABINO (1981: 30) aberrant in *C. callipeplum* (Dall, 1881) (Fig. 88 d), recent radular study confirmed this formula and tooth morphology for three additional species; I now consider it a generic character. Shells of all four species have similar characteristics, large, with pronounced curvature, rapidly increasing from apex to oral aperture, with high W/w ratio, slight dorsoventral depression, smooth and shiny.
For remarks on the nomenclature of the names *Eboreidens* and Eboreidentidae, see under *Graptacme lactea*.

Calliodentalium semitracheatum (Boissevain, 1906)

Figs 79, 82 a-d, 88 a

Dentalium semitracheatum Boissevain, 1906: 56, pl. 4, figs 20-21.

Synonym:

Dentalium (Plagioglypta) curvotracheatum Plate, 1908a: 358, pl. 30, fig. 47 (**Syn. nov.**).

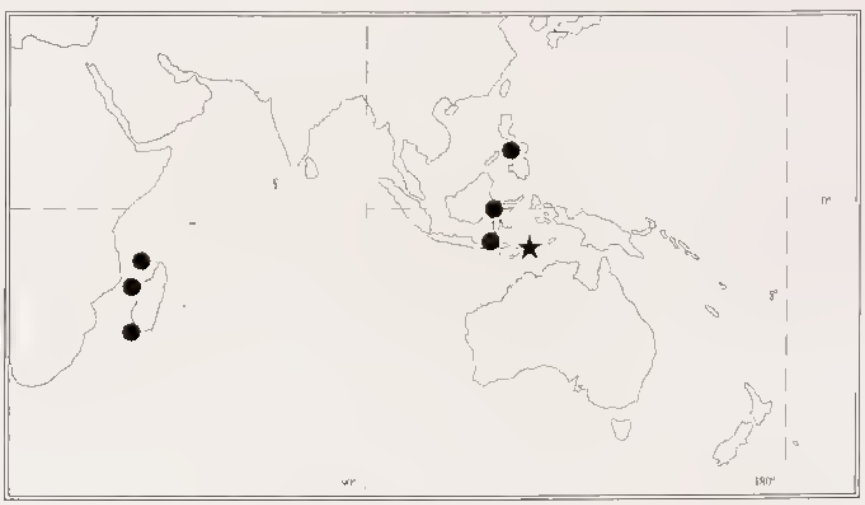


FIG. 79. — Distribution of *Calliodentalium semitracheatum*.

TYPE MATERIAL. — *D. semitracheatum*: lectotype (here designated) ZMA 3.06.072, paralectotypes ZMA 3.06.071. — *D. curvotracheatum*: holotype ZMB 61086 (*fide* KILIAS, 1995).

TYPE LOCALITY. — *D. semitracheatum*: "*Siboga*", stn 284, 08°43′ S, 127°17′ E, 828 m, Timor Sea. — *D. curvotracheatum*: "*Valdivia*", stn 245, 05°28′ S, 39°18′ E, 463 m, Zanzibar Channel.

MATERIAL EXAMINED. — The type material.
Philippines. MUSORSTOM 1: stn CP 44, 13°47′ N, 120°30′ E, 592-610 m, 2 dd.
MUSORSTOM 2: stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 4 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 2 lv, 2 dd. — Stn CP 82, 13°46′ N, 120°28′ E, 550 m, 2 lv.

Source : MNHN, Paris

MUSORSTOM 3: stn DR 93, 13°49' N, 120°02' E, 540 m, 2 lv, 2 dd. — Stn CP 106, 13°47' N, 120°30' E, 640-668 m, 3 dd.
Indonesia. *"Snellius"* II: stn 4.113, 08°19' S, 118°16' E (no depth data), (dd). — Stn 4.131, 08°18' S, 118°18' E, 680-800 m, (dd) (RMNH).
"Galathea": stn 490, 05°25' S, 117°03' E, 585 m, 1 dd (ZMC).
West Indian Ocean. BENTHEDI: stn DR 38, 12°55' S, 45°15' E, 200-500 m, 4 dd. — Stn DS 53, 13°00' S, 44°54' E, 755-770 m, 1 dd.
SW Madagascar. *"Mascareignes III"*, R. von Cosel coll. 1986: stn 69, 22°22' S, 43°05' E, 350-420 m, 1 dd. — Stn 78, 22°21' S, 43°03' E, 530 m, 1 lv. — Stn 81, 22°23' S, 43°03' E, 525 m, 1 dd. — Stn 127, 22°21' S, 43°02' E, 610 m, 1 lv. — Baie de Fanemotra, 450 m, 1 dd.
Madagascar. *"Vauban"*, A. Crosnier coll. 1973: stn 49, 15°18' S, 46°10' E, 500-550 m, 2 dd. — Stn 50, 15°19' S, 46°12' E, 405 m, 3 dd. — Stn 112, 22°18' S, 43°02' E, 640-660 m, 1 lv. — Stn 114, 22°15' S, 43°05' E, 470-475 m, 2 dd.

DISTRIBUTION. — The Philippines and Indonesia, now extended to Madagascar, live records from 450 to 865 m (present paper).

Calliodentalium crocinum (Dall, 1907)

Figs 80, 88 b

Dentalium crocinum Dall, 1907: 169, pl. 27, fig. 6.

Other references:

Dentalium (*Laevidentalium*) *crocinum* – KIRA, 1955: 80, pl. 40, fig. 9. — HABE, 1955: 10.
Laevidentalium crocinum – HABE, 1963: 268, pl. 38, figs 29, 35, textfigs 28-29. — HABE & KOSUGE, 1964: 7.
Calliodentalium crocinum – HABE, 1964a: 31, pl. 2, fig. 35; pl. 4, figs 28-29; 1977: 336, pl. 70, figs 7-8. — SPRINGSTEEN & LEOBRERA, 1985: 287, pl. 82, fig. 9. — HABE *et al.*, 1986: 24. — HIGO & GOTO, 1993: 688.

TYPE MATERIAL. — Holotype USNM 110508.

TYPE LOCALITY. — Japan, Gulf of Tokyo, *"Albatross"*, stn 5094, in 188 fms [161 m].

MATERIAL EXAMINED. — The type material.
Philippines. MUSORSTOM 3: stn CP 99, 14°01' N, 120°19' E, 196-204 m, 1 lv. — Stn CP 101, 14°00' N, 120°19' E, 194-196 m, 1 lv. — Stn DR 126, 11°49' N, 121°22' E, 266 m, 1 lv.

FIG. 80. — Distribution of *Calliodentalium crocinum*.

Source : MNHN, Paris

DISTRIBUTION. — Japan Sea (HABE, 1957) to the Philippines (SPRINGSTEEN & LEOBRERA, 1985). Recorded alive from 194 to 266 m (present paper).

Calliodentalium balanoides (Plate, 1908)

Figs 81, 82 e-f, 88 c

Dentalium (Laevidentalium) balanoides Plate, 1908a: 357, pl. 30, figs 42-44.

TYPE MATERIAL. — Holotype ZMB 61109 (*fide* KILIAS, 1995).

TYPE LOCALITY. — *"Valdivia"*, stn 186, 03°22′ S, 101°11′ E, 903 m, West Sumatra.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 1 dd.
BIOCAL: stn CP 108, 22°03′ S, 167°06′ E, 335 m, 1 dd.
MUSORSTOM 4: stn CC 247, 22°09′ S, 167°13′ E, 435-460 m, 1 lv.
BIOGEOCAL: stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 1 dd.
Passe de Boulari, B. Richer/ORSTOM coll., 400 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 426, 20°25′ S, 166°23′ E, 610 m, 1 dd.
Philippines. MUSORSTOM 2: stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 3 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865-866 m, 4 dd. — Stn CP 71, 14°00′ N, 120°18′ E, 189-197 m, 1 lv. — Stn CP 75, 13°51′ N, 120°30′ E, 300-330 m, 1 lv.
MUSORSTOM 3: stn DR 95, 13°56′ N, 119°59′ E, 865 m, 1 lv, 1dd. — Stn CP 112, 14°00′ N, 120°18′ E, 187-199 m, 1 lv. — Stn DR 126, 11°49′ N, 121°22′ E, 266 m, 4 dd.

FIG. 81. — Distribution of *Calliodentalium balanoides*.

DISTRIBUTION. — Sumatra, now extended to the Philippines and New Caledonia, living from 187 to 865 m.

Source : MNHN, Paris

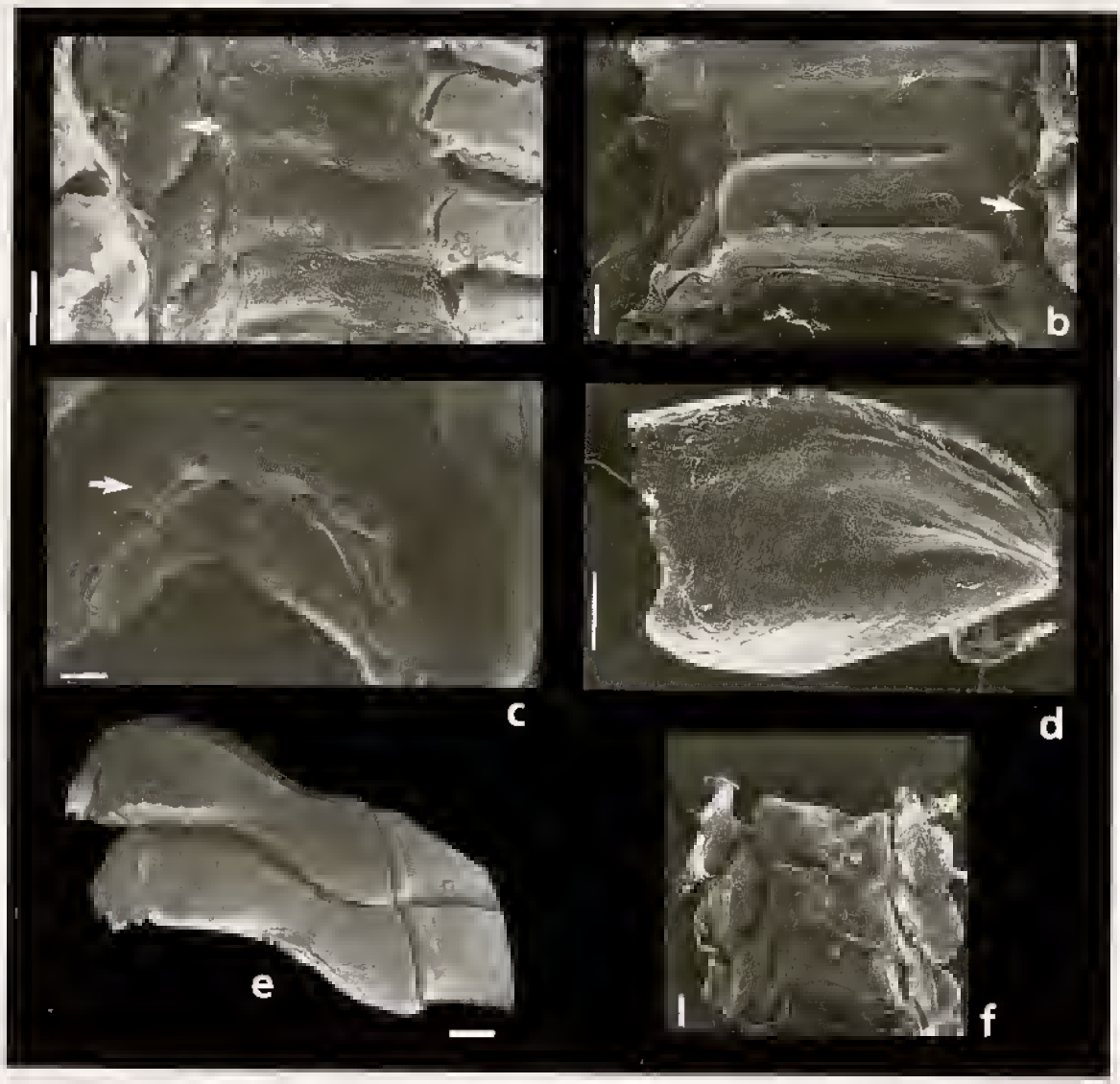


FIG. 82. — **a-d**, *Calliodentalium semitracheatum*, internal view of the radula, note the secondary teeth at left. — **b**, external face of the rachidians and secondary teeth (arrows). — **c**, anterior view of the radula, note the position of the secondary teeth. — **d**, secondary denticle. — **e**, *Calliodentalium balanoides*, lateral teeth. — **f**, internal face of the rachidians and secondary teeth. Scale lines: 100 µm (a-c, e, f), 10 µm (d).

Family FUSTIARIIDAE Steiner, 1991

Genus *FUSTIARIA* Stoliczka, 1868

Type species (SD by PILSBRY & SHARP, 1897): *Dentalium circinatum* Sowerby, 1823. Eocene, Paris Basin, France.

DIAGNOSIS. — *Shell* medium, well curved, fragile but not thin, shiny, translucent white, yellow, orange, red, lacking sculpture. Apex with long, regular slit or short v-shape notch; section circular throughout.

Radula rachidian well curved in section, granulose; lateral with strong, armed granulose head; marginal slightly sinusoidal.

Source : MNHN, Paris

DISTRIBUTION. — Triassic-Recent, worldwide, temperate and tropical waters, sublittoral to shelf and bathyal.

Fustiaria nipponica (Yokoyama, 1922)

Figs 83, 88 e

Dentalium (Fustiaria) nipponicum Yokoyama, 1922: 119, pl. 6, fig. 7.

Synonyms:

Dentalium nagoense Dall, 1927: 1.
Dentalium (Fustiaria) numatai Hirase, 1931: 139, pl. 3, fig. 11.

Other references:

Dentalium (Fustiaria) nipponicum – HIRASE, 1931: 139, pl. 3, fig. 11. — HABE, 1957: 131.
Fustiaria nipponica – HABE, 1964a: 27, pl. 2, figs 6-8; pl. 3, figs 8, 11; pl. 4, figs 1-2; 1971: 490 (Japanese text), 308 (English text), pl. 116, figs 15-16; 1977: 336, pl. 69, figs 1-2. — HABE & KOSUGE, 1964: 6. — SPRINGSTEEN & LEOBRERA, 1985: 287, pl. 82, fig. 8. — HIGO & GOTO, 1993: 687.
Fustiaria (Fustiaria) nipponica – HABE, 1963: 266, pl. 38, figs 6-8, 26, textfigs 1-2.
Dentalium politum – BOISSEVAIN, 1906: 58, pl. 1, fig. 20.
Dentalium stenoschizum – BOISSEVAIN, 1906: 59, pl. 6, figs 16-17.
Dentalium nagoense – HABE, 1964b: 140, pl. 9, figs 1-2.
Dentalium (Fustiaria) numatai – HABE, 1953: 295, figs 755-756.

TYPE MATERIAL. — *D. nipponicum* and *D. numatai*: depository not checked. — *D. nagoense*: holotype USNM 333718.

TYPE LOCALITY. — *D. nipponicum*: Shito, Honshu, Japan (Pleistocene). — *D. nagoense*: Japan, Nago, Okinawa, 15 fms [27 m]. — *D. numatai*: Japan, Osumi and Oshima.

MATERIAL EXAMINED. — The holotype of *D. nagoense*. Material identified as *D. stenoschizum* and *D. politum* by BOISSEVAIN (1906).
Chesterfield Islands. CHALCAL 1: stn DC 17, 19°12′ S, 158°56′ E, 44 m, 2 lv, 1 dd. — Stn D 34, 19°52′ S, 158°20′ E, 33-37 m, 1 dd.
CORAIL 2: stn DW 72, 19°15′ S, 158°21′ E, 32 m, 1 lv. — Stn DW 77, 19°12′ S, 158°36′ E, 60 m, 1 lv. — Stn DW 126, 19°28′ S, 158°27′ E, 46 m, 1 lv, 1 dd. — Stn DW 147, 19°37′ S, 158°14′ E, 25 m, 1 lv.
New Caledonia. LAGON: stn 4, 22°13′ S, 166°21′ E, 9 m, 1 lv, 3 dd. — Stn 8, 22°23′ S, 166°18′ E, 15 m, 2 lv, 4 dd. — Stn 21, 22°23′ S, 166°23′ E, 10 m, 1 dd. — Stn 50, 22°17′ S, 166°12′ E, 12 m, 1 dd. — Stn 51, 22°15′ S, 166°11′ E, 10 m, 1 lv. — Stn 63, 22°26′ S, 166°26′ E, 20 m, 1 lv. — Stn 64, 22°28′ S, 166°25′ E, 15 m, 1 lv. — Stn 65, 22°29′ S, 166°26′ E, 24 m, 2 lv, 2 dd. — Stn 66, 22°28′ S, 166°27′ E, 15 m, 2 lv, 1 dd. — Stn 68, 22°24′ S, 166°30′ E, 22-40 m, 1 lv. — Stn 80, 22°31′ S, 166°28′ E, 33 m, 1 lv. — Stn 83, 22°32′ S, 166°30′ E, 22 m, 1 dd. — Stn 84, 22°30′ S, 166°31′ E, 17 m, 2 lv. — Stn 98, 22°36′ S, 166°32′ E, 15 m, 3 dd. — Stn 161, 22°34′ S, 166°38′ E, 20 m, 1 lv, 1 dd. — Stn 163, 22°12′ S, 166°18′ E, 15 m, 1 lv, 1 dd. — Stn 170, 22°09′ S, 166°07′ E, 22 m, 3 lv. — Stn 185, 22°05′ S, 166°02′ E, 15 m, 1 lv. — Stn 211, 21°55′ S, 165°52′ E, 12 m, 1 lv. — Stn 212, 21°56′ S, 165°53′ E, 10 m, 1 lv. — Stn 214, 21°55′ S, 165°48′ E, 12 m, 1 dd. — Stn 217, 21°53′ S, 165°47′ E, 16 m, 1 dd. — Stn 226, 22°38′ S, 166°39′ E, 28 m, 4 lv, 3 dd. — Stn 233, 22°35′ S, 166°46′ E, 30 m, 1 lv. — Stn 268, 22°20′ S, 166°17′ E, 24 m, 1 lv. — Stn 281, 22°24′ S, 166°24′ E, 10 m, 1 lv. — Stn 284, 22°26′ S, 166°25′ E, 6 m, 3 lv, 1 dd. — Stn 293, 22°42′ S, 166°41′ E, 20 m, 6 lv, 4 dd. — Stn 296, 22°41′ S, 166°44′ E, 26 m, 1 lv. — Stn 304, 22°40′ S, 166°48′ E, 27 m, 1 lv, 1 dd. — Stn 311, 22°44′ S, 166°47′ E, 36 m, 1 lv, 1 dd. — Stn 322, 22°30′ S, 166°58′ E, 71 m, 2 lv. — Stn 340, 22°48′ S, 166°47′ E, 27 m, 1 lv. — Stn 438, 18°10′ S, 162°51′ E, 37 m, 1 lv, 1 dd. — Stn 441, 18°04′ S, 162°56′ E, 37 m, 3 dd. — Stn 442bis, 18°02′ S, 162°56′ E, 39 m, 1 dd. — Stn 446, 18°19′ S, 163°04′ E, 36 m, 7 lv, 3 dd. — Stn 448, 18°22′ S, 163°07′ E, 30 m, 1 lv. — Stn 449, 18°22′ S, 163°09′ E, 21 m, 1 lv. — Stn 450, 18°24′ S, 163°24′ E, 29 m, 1 lv, 1 dd. — Stn 453, 18°29′ S, 163°12′ E,

Source : MNHN, Paris

26 m, 1 lv, 4 dd. — Stn 465, 18°22′ S, 163°05′ E, 45 m, 2 lv, 5 dd. — Stn 466, 18°24′ S, 163°07′ E, 42 m, 5 lv, 2 dd. — Stn 467, 18°25′ S, 163°08′ E, 41 m, 3 lv, 1 dd. — Stn 468, 18°27′ S, 163°10′ E, 40 m, 1 lv. — Stn 469, 18°29′ S, 163°10′ E, 39 m, 1 lv, 1 dd. — Stn 470, 18°28′ S, 163°09′ E, 41 m, 1 dd. — Stn 471, 18°28′ S, 163°07′ E, 42 m, 2 lv, 1 dd. — Stn 473, 18°24′ S, 163°03′ E, 50 m, 1 lv, 3 dd. — Stn 481, 18°57′ S, 163°32′ E, 33 m, 3 lv, 7 dd. — Stn 482, 18°49′ S, 163°31′ E, 33 m, 1 lv, 8 dd. — Stn 512, 19°24′ S, 163°35′ E, 59 m, 1 lv, 3 dd. — Stn 519, 19°02′ S, 163°34′ E, 39 m, 1 lv, 2 dd. — Stn 536, 19°09′ S, 163°23′ E, 61 m, 14 lv. — Stn 554, 22°50′ S, 166°54′ E, 27 m, 1 lv. — Stn 866, 20°38′ S, 165°03′ E, 26 m, 1 lv. — Stn 871, 20°37′ S, 165°00′ E, 27 m, 1 lv. — Stn 916, 20°56′ S, 164°28′ E, 13 m, 2 lv. — Stn 932, 20°46′ S, 164°17′ E, 23 m, 3 dd. — Stn 937, 20°40′ S, 164°15′ E, 50-55 m, 1 lv. — Stn 943, 20°37′ S, 164°11′ E, 15 m, 1 dd. — Stn 984, 20°21′ S, 163°56′ E, 21-23 m, 1 dd. — Stn 1015, 20°10′ S, 163°52′ E, 25 m, 1 dd. — Stn 1025, 20°07′ S, 163°49′ E, 25-28 m, 1 lv. — Stn 1105, 19°40′ S, 163°57′ E, 25 m, 4 dd. — Stn 1118, 19°35′ S, 163°52′ E, 30 m, 2 lv, 2 dd. — Stn 1145, 19°21′ S, 163°45′ E, 38 m, 1 dd. — Stn 1146, 19°08′ S, 163°31′ E, 185 m, 1 dd. — Stn 1154, 19°09′ S, 163°19′ E, 40 m, 1 lv, 1 dd.

Loyalty Islands. MUSORSTOM 6: stn DW 430, 20°21′ S, 166°07′ E, 30 m, 1 lv, 1dd. — Stn DW 431, 20°22′ S, 166°10′ E, 21 m, 1 lv. — Stn DW 435, 20°21′ S, 166°08′ E, 32 m, 2 lv, 1 dd.

Indonesia. *"Snellius"* II: stn 4.020, 05°57′ S, 123°46′ E, 255-275 m, 1 dd. — Stn 4.153, 06°22, S, 120°26′ E, 130-155 m, 1 lv. — Stn 4.155, 06°22′ S, 120°26′ E, 233-274 m, 1 dd (RMNH).

Philippines. MUSORSTOM 3: stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 1 dd.

FIG. 83. — Distribution of *Fustiaria nipponica*.

DISTRIBUTION. — Japan, the Philippines, China, 0-200 m (HABE & KOSUGE, 1964), now extended to New Caledonia, living from 6 to 71 m (present paper).

Fustiaria engischista (Barnard, 1963)

Figs 84, 88 f

Dentalium engischistum Barnard, 1963b: 351, fig. 30 f.

TYPE MATERIAL. — Holotype SAM A5463, paratypes BMNH 1964.256.

TYPE LOCALITY. — South Africa, off Cape Natal (Durban), 62 fms [113 m].

Source : MNHN, Paris

MATERIAL EXAMINED. — The type material.
West Indian Ocean. BENTHEDI: stn DR 08, 11°29′ S, 47°18′ E, 250 m, 1 dd. — Stn F 77, 12°34′ S, 44°54′ E, 480-530 m, 1 dd. — Stn DR 104, 11°26′ S, 47°22′ E, 330-530 m, 1 dd.
MD32 Réunion: stn DS 178, 21°24′ S, 55°10′ E, 412-460 m, 1 lv.
Nosy Bé Island, NW Madagascar, Plante coll., 6 dd (BMNH).

FIG. 84. — Distribution of *Fustiaria engischista*.

DISTRIBUTION. — Southwestern Indian Ocean from Natal to NW Madagascar and Réunion Island, alive in 412-460 m.

Fustiaria caesura (Colman, 1958)

Figs 78 d, 85, 88 g, j

Dentalium (Pseudoantalis) caesura Colman, 1958: 145, fig. 11.

FIG. 85. — Distribution of *Fustiaria caesura*.

Source : MNHN, Paris

TYPE MATERIAL. — Holotype AMS C62230, paratypes C62229.

TYPE LOCALITY. — Australia, off Willongong, New South Wales, 183 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DC 266, 25°20′ S, 159°46′ E, 240 m, 1 lv. — Stn DC 357, 19°37′ S, 158°46′ E, 630 m, 1 dd. — Stn DC 380, 19°38′ S, 158°44′ E, 555-570 m, 1 dd.
New Caledonia. MUSORSTOM 4: stn DW 159, 18°46′ S, 163°16′ E, 585 m, 3 dd.
Philippines. MUSORSTOM 2: stn DR 34, 13°28′ N, 121°12′ E, 155-167 m, 2 lv.
MUSORSTOM 3: stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 1 dd.

DISTRIBUTION. — E Australia, now extended to New Caledonia and the Philippines. Live records from 155 to 240 m.

Fustiaria langfordi (Habe, 1963)

Figs 71 e, 86, 88 h

Laevidentalium langfordi Habe, 1963: 268, pl. 38, fig. 22.

Other references:

Laevidentalium langfordi — HABE, 1964a: 35, pl. 2, fig. 22; 1971: 491 (Japanese text), 309 (English text), pl. 65, figs 30-31. — HABE & KOSUGE, 1964: 7. — HABE *et al.*, 1986: 24. — HIGO & GOTO, 1993: 687 (as synonym of *Laevidentalium longitrorsum*).

TYPE MATERIAL. — Holotype NSMT.

TYPE LOCALITY. — Itoman, Okinawa Island, Ryukyu Islands.

MATERIAL EXAMINED. — **Chesterfield Islands**. CHALCAL 1: stn DC 20, 19°12′ S, 158°42′ E, 67 m, 6 dd. — Stn DC 31, 19°33′ S, 158°30′ E, 230 m, 1 dd. — Stn DC 33, 19°45′ S, 158°26′ E, 205 m, 2 lv, 10 dd. — Stn DC 35, 19°45′ S, 158°26′ E, 210 m, 2 dd. — Stn DC 38, 20°00′ S, 158°46′ E, 250 m, 12 dd. — Stn DC 63, 22°11′ S, 159°15′ E, 305 m, 6 dd. — Stn DC 64, 22°12′ S, 159°15′ E, 305 m, 1 lv, 2 dd.
CORAIL 2: stn DW 114, 19°25′ S, 158°38′ E, 217 m, 1 dd. — Stn DW 129, 19°28′ S, 158°34′ E, 215 m, 2 lv, 3 dd. — Stn DW 167, 19°46′ S, 158°29′ E, 270 m, 2 dd.
MUSORSTOM 5: stn DW 263, 25°21′ S, 159°46′ E, 150-225 m, 9 dd. — Stn DW 265, 25°21′ S, 159°45′ E, 190-260 m, 3 lv, 5 dd. — Stn DW 266, 25°20′ S, 159°46′ E, 240 m, 1 lv, 6 dd. — Stn DW 270, 24°49′ S, 159°34′ E, 223 m, 12 lv. — Stn DW 285, 24°09′ S, 159°34′ E, 245-255 m, 2 dd. — Stn CP 289, 24°02′ S, 159°38′ E, 273 m, 1 dd. — Stn DW 298, 22°44′ S, 159°22′ E, 320 m, 1 lv, 3 dd. — Stn DW 299, 22°48′ S, 159°24′ E, 360-390 m, 2 dd. — Stn DW 302, 22°10′ S, 159°23′ E, 345-360 m, 3 dd. — Stn DW 303, 22°12′ S, 159°23′ E, 332 m, 1 lv, 1 dd. — Stn CP 315, 22°25′ S, 159°27′ E, 330-335 m, 1 dd. — Stn DW 328, 20°23′ S, 158°44′ E, 340-355 m, 1 lv, 4 dd. — Stn DW 329, 20°23′ S, 158°47′ E, 320 m, 1 lv, 9 dd. — Stn DW 334, 20°06′ S, 158°48′ E, 315-320 m, 1 lv, 1 dd. — Stn DW 344, 19°39′ S, 158°34′ E, 310 m, 2 dd. — Stn DW 346, 19°40′ S, 158°27′ E, 245-252 m, 6 dd. — Stn DW 349, 19°34′ S, 158°34′ E, 275 m, 1 lv. — Stn DC 376, 19°51′ S, 158°30′ E, 280 m, 6 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 392, 20°47′ S, 167°05′ E, 340 m, 1 dd. — Stn DW 399, 20°42′ S, 167°00′ E, 282 m, 2 dd. — Stn DW 417, 20°42′ S, 167°04′ E, 283 m, 3 dd. — Stn DW 418, 20°42′ S, 167°03′ E, 283 m, 1 lv, 1 dd. — Stn DW 456, 21°01′ S, 167°26′ E, 240 m, 2 dd. — Stn DW 480, 21°08′ S, 167°56′ E, 380 m, 1 lv.
New Hebrides Arc. VOLSMAR: stn DW 17, 22°23′ S, 171°41′ E, 260-300 m, 4 dd.
Indonesia. *"Snellius"* II: stn 4.047, 09°53′ S, 120°43′ E, 100 m, 2 dd (RMNH).

Source : MNHN, Paris

FIG. 86. — Distribution of *Fustiaria langfordi*.

DISTRIBUTION. — Japan, Malaya, 50-200 m (HABE, 1964a), now extended to Indonesia and New Caledonia, live records from 200 to 380 m.

Fustiaria vagina sp. nov.

Figs 71 h, 87, 88 i

TYPE MATERIAL. — Holotype MNHN. Paratypes: 8 MNHN, 1 AMS C201726, 1 NMNZ M268953, 1 USNM.

TYPE LOCALITY. — New Caledonia, Chesterfield Islands, MUSORSTOM 5, stn DW 340, 19°49′ S, 158°41′ E, 675-680 m.

FIG. 87. — Distribution of *Fustiaria vagina*.

Source : MNHN, Paris

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 340, 19°49′ S, 158°41′ E, 675-680 m, 3 lv (holotype, 1 paratype AMS). — Stn DW 341, 19°46′ S, 158°43′ E, 630-620 m, 1 lv (paratype). — Stn DW 353, 19°27′ S, 158°40′ E, 290 m, 1 dd (paratype). — Stn DW 357, 19°37′ S, 158°46′ E, 630 m, 1 lv (paratype).
New Caledonia. BIOCAL: stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 2 dd (paratypes). — Stn DW 49, 23°03′ S, 167°32′ E, 825-830 m, 3 dd (paratypes: 2 MNHN, 1 NMNZ).
BIOGEOCAL: stn CP 290, 20°37′ S, 167°03′ E, 760-920 m, 1 dd (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 468, 21°06′ S, 167°33′ E, 600 m, 1 dd (paratype USNM).

DISTRIBUTION. — New Caledonia, recorded alive in 630-680 m, shells from 290 to 820 m.

DESCRIPTION. — *Shell* to 30 mm, solid, white, glossy, slighily curved, sculptured with growth lines only, conspicuous at posterior end. Apex truncate, oblique on ventral side, with strong callus. Lumen longitudinalty elongate, with projecting irregular walls on ventral side. In section, walls are wider on dorsal than on ventral side. Peristome oblique, fragile. Section circular throughout.
Measurements: holotype L 29, W 2.8, w 1, arc 1; paratypes range L 19-29, W 2-3.2, w 0.6-1.5, arc 0.6-1.5. W/w ratio 2.6.

REMARKS. — EMERSON (1962) explicity noted that the genus has varied apical structures. The present species is provisionally placed in *Fustiaria* pending anatomical study.

ETYMOLOGY. — Named for the resemblance of apical structure to the human female vagina.

Other species of *Fustiaria* cited in the literature

Fustiaria rubescens (Deshayes, 1825): 363, pl. 16, figs 23-24. Mediterranean Sea. MNHN. Cited by LUDBROOK (1954) as present off Zanzibar, *"John Murray"*, stn 103, 05°39′ S, 39°11′ E, 101 m. It is doubtful that this Mediterranean species occurs in the Indo-Pacific and LUDBROOK's record should be checked.

Family GADILINIDAE Chistikov, 1975

Subfamily GADILININAE Chistikov, 1975

Genus *GADILINA* Foresti, 1895

Type species (by monotypy): *Dentalium triquetrum* Brocchi, 1814. Miocene, Italy.

DIAGNOSIS. — *Shell* medium to large, well curved, solid, polished, shiny, white. Longitudinally sculptured with two dorso-lateral ribs, more conspicuous at apex, slightly convex dorsally, strongly concave ventrally. Apex truncate, with terminal callus, lumen circular. Section compressed dorsally, circular ventrally.
Radula rachidian slightly curved in section, anterior margin irregular, three wide cusps ventrally; lateral wide, with three primary cusps, the central quite pointed; marginal sinusoidal, with cusp in anterior angle connecting with laterals.

DISTRIBUTION. — Miocene-Recent. Pacific and Indian Oceans, absent in the Atlantic Ocean; temperate-tropical belt, shelf to abyssal.

Source : MNHN, Paris

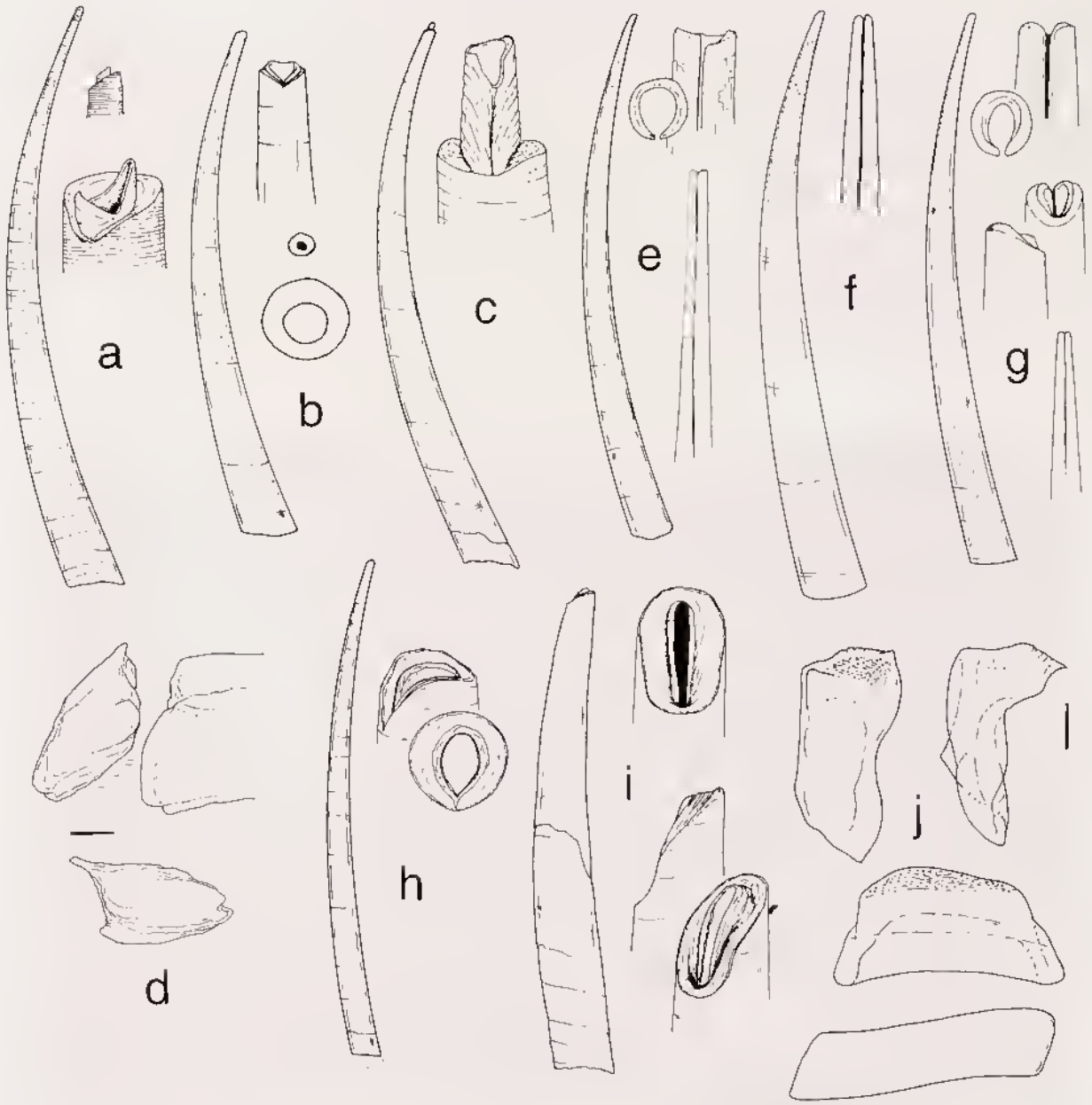


FIG. 88. — **a**, *Calliodentalium semitracheatum*, shell (68 mm) and apex. *"Mascareignes III"*: stn 78. — **b**, *Calliodentalium crocinum*, shell (39 mm), apex, apical and medial sections, MUSORSTOM 3: stn CP 99. — **c**, *Calliodentalium balanoides*, shell (65 mm) and apex, *"Vauban"* 1978-79: stn 40. — **d**, *Calliodentalium* type radula (*Calliodentalium callipeplum*, Caribbean Sea), left accessory denticle, relationship with the rachidian (see also Fig. 82 e). — **e**, *Fustiaria nipponica*, shell (51 mm), apex and apical section, New Caledonia LAGON: stn 214. — **f**, *Fustiaria engischista*, shell (41 mm), and apex, Nosy-Bé (BMNH). — **g**, *Fustiaria caesura*, shell (44 mm), apical views and apical section, MUSORSTOM 2: stn DR 34. — **h**, *Fustiaria langfordi*, shell (49 mm), apex and apical section, MUSORSTOM 6: stn DW 417. — **i**, *Fustiaria vagina* sp. nov., paratype (26.4 mm), views of the apex. — **j**. *Fustiaria* type radula (*F. caesura*); see also Fig. 78 d.

Source : MNHN, Paris

Gadilina insolita (Smith, 1894)

Figs 89, 90 a-f, 95 a-b

Dentalium insolitum Smith, 1894: 168, pl. 4, figs 17-17a.

Synonym:

Dentalium stapes Boissevain, 1906: 50, pl. 5, figs 16-20, pl. 6, figs 79, 81, 83.

Other references:

Dentalium insolitum – Pilsbry & Sharp, 1897: 109, pl. 22, figs 56-57. — Smith, 1906a: 250. — Boissevain, 1906: 49, pl. 5, fig. 15, pl. 6, figs 80-82, 84. — Winckworth, 1940a: 25.
Dentalium (Gadilina) insolitum – Plate, 1908a: 353, pl. 30, figs 50-51. — Jaeckel, 1932: 306. — Ludbrook, 1954: 108.
Gadilina insoluta (*sic*) – Habe, 1964a: 32, pl. 2 fig. 23; pl. 4, figs 13-14. — Habe & Kosuge, 1964: 7. — Higo & Goto, 1993: 688.
Dentalium (Gadilina) stapes – Ludbrook, 1954: 109.
Gadilina stapes – Habe, 1962: 105, pl. 47, fig. 6; 1963: 270, pl. 38, fig. 23, textfigs 13-14; 1964a: 32, pl. 2, fig. 23, pl. 4, figs 13-14. — Okutani, 1964: 76. — Habe & Kosuge, 1964: 7.

Fig. 89. — Distribution of *Gadilina insolita*.

Type material. — *D. insolitum*: 2 syntypes dd BMNH 1952.3.25.83-93. — *D. stapes*: syntypes ZMA 3.06.061, 3.06.062.

Type locality. — *D. insolita*: Bay of Bengal, "*Investigator*", in 597 fms [1091 m]. — *D. stapes*: Indonesia, Banda Sea, "*Siboga*", stn 212, 05°55' S, 120°10' E, 462 m.

Material examined. — The type material.
New Caledonia. BIOCAL: stn DW 56, 23°35' S, 167°12' E, 695-705 m, 1 lv. – Stn DW 106, 21°36' S, 166°29' E, 625-650 m, 2 lv.
BIOGEOCAL: stn CP 232, 21°34' S, 166°27' E, 760-790 m, 2 lv, 1 dd.
LAGON: stn 993, 20°15' S, 163°53' E, 375-400 m, 1 dd.
Indonesia. CORINDON: stn B 210, 00°13' S, 117°53' E, 338 m, 1 dd. — Stn B 213, 00°31' N, 117° 50' E, 488 m, 1 dd.
"*Snellius*" II: stn 4.113, 08°19' S, 118°16' E (no depth data), 1 dd. — Stn 4.127, 08°19' S, 118°18' E, 700-835 m, 2 lv, 1 dd. — Stn 4.128, 08°18' S, 118°16' E, 700-835 m, 2 lv, 1 dd. — Stn 4.130, 08°18' S, 118°18' E, 700-730 m, 2 lv, 1 dd. — Stn 4.267, 08°18' S, 118°21' E, 650 m, 1 lv (RMNH).
Philippines. MUSORSTOM 1: stn CP 49, 13°49' N, 120°00' E, 750-925 m, 1 dd.

Source : MNHN, Paris

MUSORSTOM 2: stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 1 dd.— Stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 13 dd, 9 lv. — Stn CP 51, 13°59′ N, 120°16′ E, 170-187 m, 1 lv. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 6 lv. — Stn CP 78, 13°49′ N, 120°28′ E, 441-550 m, 2 lv, 6 dd. — Stn CP 81, 13°34′ N, 120°31′ E, 856-884 m, 3 lv. — Stn CP 82, 13°46′ N, 120°28′ E, 550 m, 1 lv, 2 dd.
MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd. — Stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 1 lv, 2 dd. — Stn CP 118, 11°58′ N, 121°06′ E, 448-466 m, 3 lv, 6 dd. — Stn CP 122, 12°20′ N, 121°42′ E, 219-220 m, 2 lv, 1 dd. — Stn CP 123, 12°10′ N, 121°45′ E, 700-702 m, 2 dd. — Stn CP 128, 11°50′ N, 121° 42′ E, 815-821 m, 5 dd.

DISTRIBUTION. — Indonesia, Japan, Indian Ocean, now extended to New Caledonia, living from 625 to 950 m (present paper), shells in 200-1134 m (HABE & KOSUGE, 1964).

REMARKS. — I concur with HABE (1964a) in considering this a single highly variable species as examination of a large series shows clear gradation between forms.

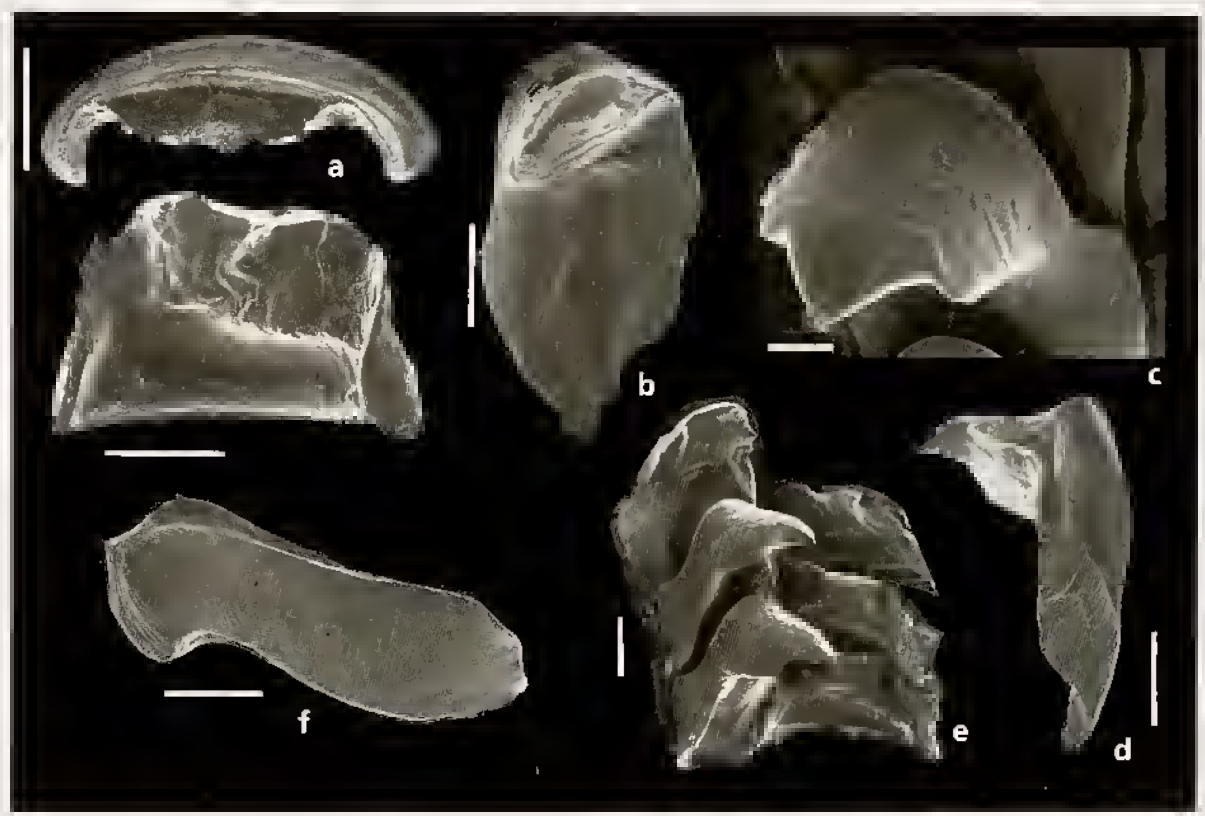


FIG. 90. — Radulae. — **a**, *Gadilina insolita*, rachidian, view from the anterior border and internal face. — **b**, lateral internal face. — **c**, lateral, head. — **d**, lateral, internal face. — **e**, marginal, contact with lateral at left side. — **f**, *Gadilina insolita* form *stapes*, general view. Scale bars: 100 µm (b-f), 10 µm (a).

Other Indo-Pacific species of *Gadilina* cited in the literature

Gadilina pachypleura (Boissevain, 1906): 51, pl. 5, figs 21-22. *"Siboga"*, stn 208, 05°39′ S, 122°12′ E, Banda Sea, 1886 m. ZMA.

Source : MNHN, Paris

Subfamily EPISIPHONINAE Chistikov, 1975

Genus *EPISIPHON* Pilsbry & Sharp, 1897

Type species (SD by SUTER, 1913): *Dentalium sowerbyi* Guilding, 1834. Recent, Caribbean Sea.

DIAGNOSIS. — *Shell* small to medium, slightly curved, fragile but not thin, polished, shiny, white, cream, orange or red. Sculptured apically with close, fine, encircled wrinkles; rarely longitudinal striae near the apex or throughout. Section subcircular or subtriangular, slightly compressed dorsoventrally, more on ventral side. Apex simple or truncate, with terminal callus, lumen circular, small with short pipe.
Radula rachidian slightly curved in section, anterior margin irregular, nearly straight, three cusps on internal face; lateral with few very sharp, pointed cusps; marginal sinusoidal, short.

DISTRIBUTION. — Worldwide. Temperate-tropical waters, sublittoral-shelf.

Episiphon subtorquatum (Fischer, 1871)

Figs 91, 95 c, f

Dentalium subtorquatum Fischer, 1871: 212, pl. 11, figs 1-1a.

Synonyms:

Dentalium annulosum Brazier, 1877: 58.
Dentalium tornatum Watson, 1879: 518; 1886: 13, pl. 2, fig. 3.
Dentalium (*Episiphon*) *sewelli* Ludbrook, 1954: 107, fig. 10 (**Syn. nov.**).

Other references:

Dentalium subtorquatum – PILSBRY & SHARP, 1897: 101. — BOISSEVAIN, 1906: 57, pl. 2, fig. 27, pl. 6, fig. 36. — MOAZZO, 1939: 221.
Dentalium (Laevidentalium) subtorquatum – DELL, 1964: 129.
Episiphon subtorquatum – HABE & KOSUGE, 1964: 8.
Plagioglypta subtorquatum – HABE & KOSUGE, 1964: 8.
Dentalium annulosum – HEDLEY, 1901: 129, pl. 17, fig. 36.
Episiphon tornatus (*sic*) – HABE & KOSUGE, 1964: 6.
Plagioglypta annulosum – HABE & KOSUGE, 1964: 8.

TYPE MATERIAL. — *D. subtorquatum*: lectotype (here designated: L 11.2, W 1.3, w 0.4) MNHN. — *D. annulosum*: syntype AMS 189. — *D. tornatum*: 5 syntypes dd BMNH 87.2.9.57-60. — *D. sewelli*: holotype BMNH 1952.3.25.125.

TYPE LOCALITY. — *D. subtorquatum*: Suez. — *D. anulosum*: NE Australia, Princess Charlotte Bay. — *D. tornatum*: Levuka, Fiji, 12 fms [22 m]. — *D. sewelli*: Gulf of Oman, *"John Murray"*, stn 75, 25°10′ N, 56°47′ E, 201 m.

MATERIAL EXAMINED. — The type material and the material examined by BOISSEVAIN.
New Caledonia. LAGON: stn 729, 21°19′ S, 165°54′ E, 42-45 m, 2 lv.
West Indian Ocean. BENTHEDI: stn S 18, 12°45′ S, 45°16′ E, 15 m, 4 dd. — Stn S 23, 12°46′ S, 45°16′ E, 6 m, 1 dd. — Stn S 32, 12°45′ S, 47°18′ E, 15-20 m, 1 dd. — Stn S 36, 12°52′ S, 45°16′ E, 30 m, 4 lv. — Stn S 50, 12°55′ S, 44°59′ E, 32 m, 1 lv, 1 dd. — Stn DS 101, 11°26′ S, 47°20′ E, 26 m, 1 dd. Shimoni, Kenya, 1 lv (BMNH). — Kiloa, Zanzibar, 20 m, 1 lv, 2 dd. — Same locality, shore, 13 dd (both MNHN). — Nosy Bé Island, NW Madagascar, Plante coll., 2 lv, 28 dd. — Tuléar, Madagascar, 5 dd (both BMNH).
Red Sea. Suez, 107 dd. — Gulf of Aden, Obock, Republic of Djibouti, 3 dd. — Hodeida, Yemen, 2 dd. — Djibouti, 1 dd. — Aden, 5 dd (all Coll. JOUSSEAUME, MNHN).

Source : MNHN, Paris

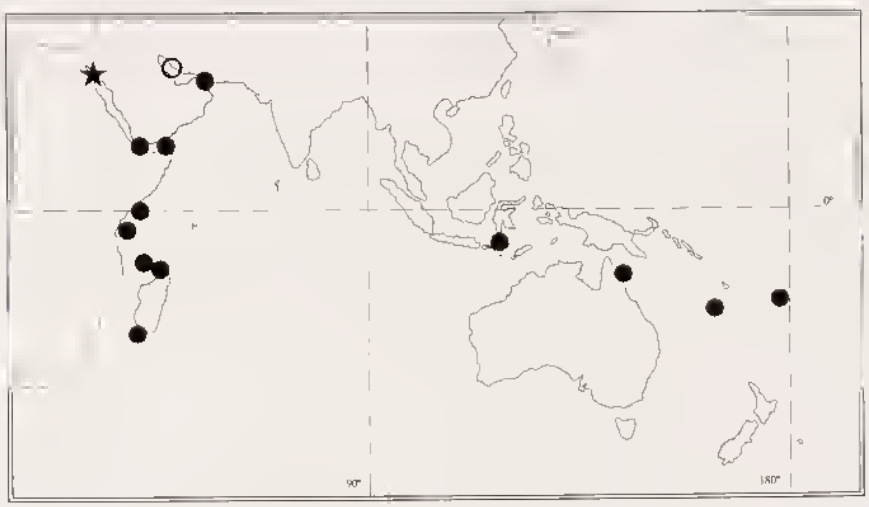


FIG. 91. — Distribution of *Episiphon subtorquatum*.

DISTRIBUTION. — Red Sea, Persian Gulf, and Zanzibar, 21-90 m (LUDBROOK, 1954, as *D. sewelli*), Indonesia (BOISSEVAIN, 1906), North Australia and Fiji, now extended to Madagascar and New Caledonia, alive in 20-45 m, shells down to 201 m.

Episiphon subrectum (Jeffreys, 1883)

Figs 92, 95 d

Dentalium subrectum Jeffreys, 1883: 661.

Synonyms:

Dentalium virgula Hedley, 1903: 328, fig. 62 (**Syn. nov.**).
Dentalium carneum Boissevain, 1906: 48, pl. 6, figs 44-45 (**Syn. nov.**).
Dentalium makiyamai Kuroda & Kikuchi, 1933: 11, pl. 5, fig. 8.

Other references:

Dentalium subrectum – PILSBRY & SHARP, 1897: 120, pl. 8, fig. 5. — BOISSEVAIN, 1906: 47, pl. 6, figs 46-50. — LUDBROOK, 1954: 108. — HABE & KOSUGE, 1964: 6. — HABE, 1964a: 28, pl. 2, fig. 1.
Episiphon carneum – HABE & KOSUGE, 1964: 6.
Episiphon makiyamai – HABE, 1963: 267, pl. 38, fig. 1. — TSUCHIDA *et al.*, 1991: 14, pl. 3, fig. 16.

TYPE MATERIAL. — *D. subrectum*: syntypes USNM (*fide* LUDBROOK, 1954) [not located]. — *D. virgula*: holotype BMNH 1913.4.30.10-14, paratypes AMS C162217. — *D. carneum*: lectotype (here designated) ZMA 3.06.052, paralectotypes ZMA 3.06.053, 073, 055.

TYPE LOCALITY. — *D. subrectum*: Philippines. — *D. virgula*: off Port Kembla, NSW, Australia, 41-50 fms [80-91 m]. — *D. carneum*: Indonesia, Flores Sea, *"Siboga"*, stn 45, 07°24′ S, 118°15′ E, 794 m. — *D. makiyamai*: Toyama Bay, Japan.

MATERIAL EXAMINED. — The type material of *D. virgula* and *D. carneum*. Material identified by BOISSEVAIN, 1906 (ZMA) and by LUDBROOK, 1954 (BMNH 1952.3.25.78-82).
Philippines. MUSORSTOM 2: stn DR 34, 13°28′ N, 121°12′ E, 155-167 m, 14 dd.
MUSORSTOM 3: stn DR 140, 11°43′ N, 122°34′ E, 93-99 m, 3 dd. — Stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 1 dd.

Source : MNHN, Paris

FIG. 92. — Distribution of *Episiphon subrectum*.

DISTRIBUTION. — NW Indian Ocean, Indonesia, Philippines, Japan, SE Australia. Shells in 54-900 m.

Episiphon virginieae sp. nov.

Figs 93, 95 e

TYPE MATERIAL. — Holotype lv, MNHN. Paratypes dd: 9 MNHN, 1 AMS C201727, 1 NMNZ M268954.

TYPE LOCALITY. — New Caledonia, Loyalty Islands, MUSORSTOM 6, stn DW 399, 20°42′ S, 167°00′ E, 282 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

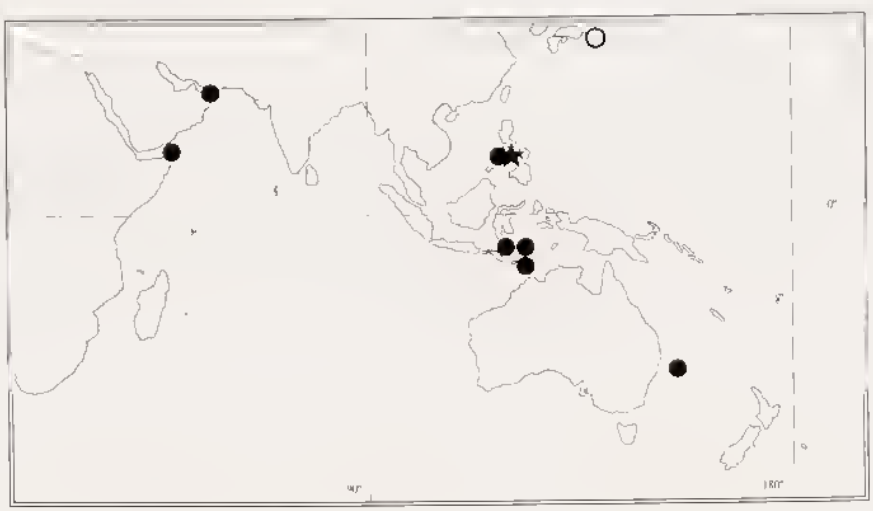


FIG. 93. — Distribution of *Episiphon virginieae*.

Source : MNHN, Paris

DESCRIPTION. — *Shell* to 9 mm long, translucent, fragile, slender, slightly curved. Fine longitudinal sculpture of close, minute lines throughout, noticeable under magnification. Apex truncate, subcircular in section, lumen subcircular with short pipe. Mouth suboval, straight.

Measurements: holotype L 8.6, W 0.9, w 0.7, arc 0.3; paratypes L 8, W 0.8, w 0.4, arc 0.6; L 7.7, W 0.9, w 0.7, arc 0.3; L 8.4, W 0.8, w 0.5, arc 0.5; L 8.3, W 0.8, w 0.4, arc 0.3; L 9.4, W 0.8, w 0.4, arc 0.5; L 7.7, W 0.9, w 0.6, arc 0.3. W/w ratio 1.3-2.

REMARKS. — The longitudinal sculpture throughout the shell is unique in the genus.

ETYMOLOGY. — Named for Virginie HEROS, MNHN, who processed much of the MUSORSTOM material, and who has assisted in many ways with this report.

Other Indo-Pacific species of *Episiphon* cited in the literature

Episiphon candelatum (Kira, 1959): 105, pl. 40, fig. 5. Japan, Tosa Bay, Shikoku, 200 m.

Episiphon gazellae (Plate, 1908): 356, pl. 30, figs 40-41. Northwest Australia, 16 m. Holotype ZMB 33195. Generic allocation uncertain.

Episiphon minutissimum Ludbrook, 1954: 108, fig. 11. Maldive area, *"John Murray"*, stn 147, 04°53′ N, 72°54′ E, 27 m. Holotype and 9 paratypes BMNH 1952. 3.25.113-123. Generic allocation uncertain.

Episiphon truncatum (Boissevain, 1906): 51, pl. 6, fig. 33, textfig. Indonesia, Banda Sea, *"Siboga"*, stn 90, 01°17′ N, 118°53′ E, 281 m. ZMA.

FIG. 94. — Distribution of *Anulidentalium bambusa*.

Subfamily ANULIDENTALIINAE Chistikov, 1975

Genus *ANULIDENTALIUM* Chistikov, 1975

Type species (by monotypy): *A. bambusa* Chistikov, 1975.

DIAGNOSIS. — *Shell* large, slightly curved to almost straight, thin, narrow, fragile, polished, translucent white. Sculpture of encircling swellings at regular intervals. Apex simple. Section subcircular, slightly compressed laterally.

Source : MNHN, Paris

Radula rachidian slighttly curved in section, with three central cusps on inner face; lateral with prominent sharp primary cusp and two secondary cusps placed laterally to each other; marginal short, sinusoidal.

DISTRIBUTION. — Recent, western Pacific Ocean. Shelf-bathyal.

Anulidentalium bambusa Chistikov, 1975

Figs 94, 95 g

Anulidentalium bambusa Chistikov, 1975: 21.

Other reference:
Anulidentalium banibusa — CHISTIKOV, 1979b: 112, fig. 4.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV, 1979) [not seen].

TYPE LOCALITY. — Gulf of Tonking, Viet Nam, 72 m.

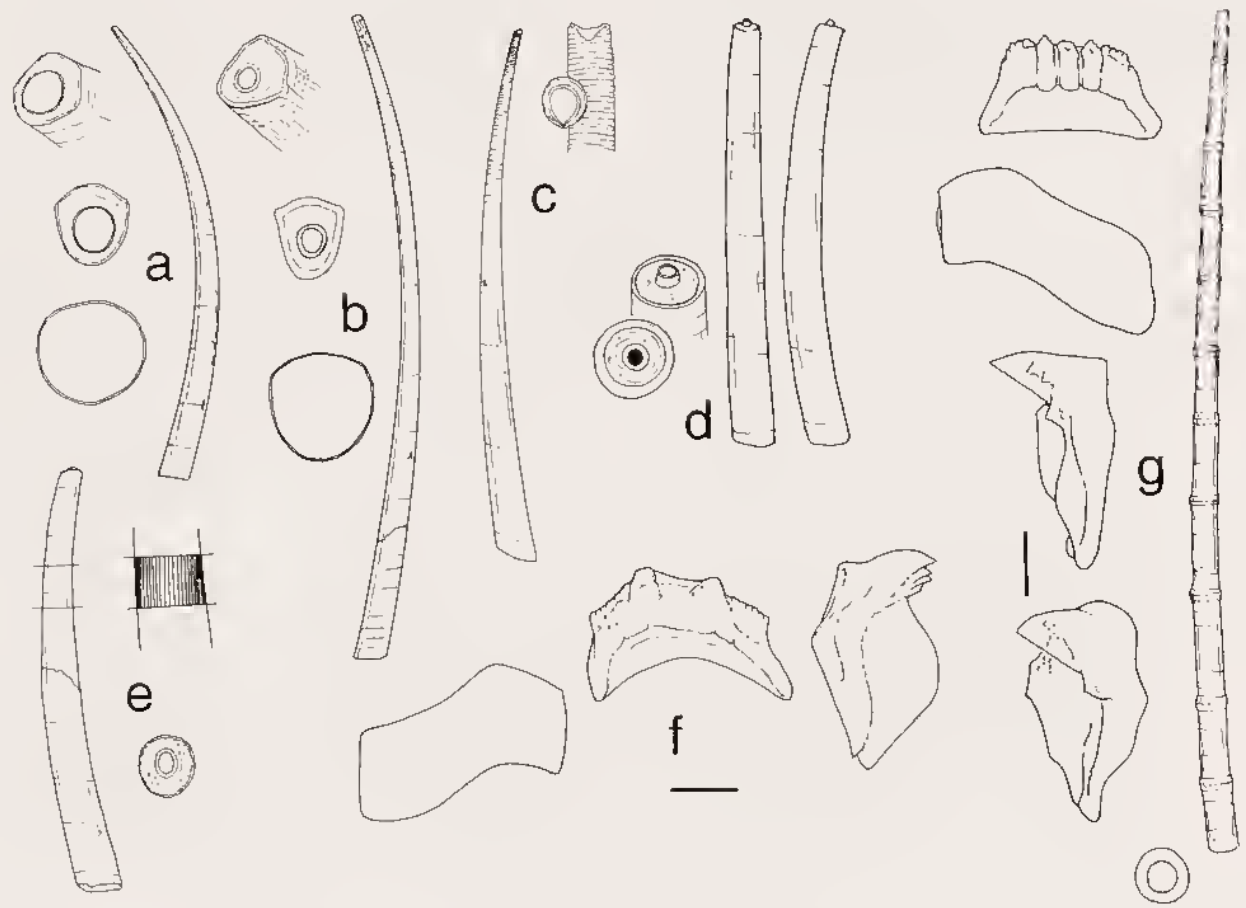


FIG. 95. — **a**, *Gadilina insolita*, shell (49 mm), apex, apical, medial and oral sections, MUSORSTOM 2: stn CP 50. — **b**, *Gadilina insolita* form *stapes*, shell (61 mm) apex, apical and oral sections, MUSORSTOM 2: stn CP 78. — **c**, *Episiphon subtorquatum*, shell (25 mm), apex and apical section, BENTHEDI: stn S 36. — **d**, *Episiphon subrectum*, shell (14 mm), apex and apical section, MUSORSTOM 2: stn DR 34. — **e**, *Episiphon virginieae* sp. nov., holotype, shell (8.6 mm), detail of sculpture and apical section. — **f**, *Episiphon* type radula (*E. subtorquatum*). — **g**, *Anulidentalium bambusa*, shell (52 mm), apical section, MUSORSTOM 3: stn CP 139; *Anulidentalium* type radula (*A. bambusum*) (after CHISTIKOV, 1979b).

Source : MNHN, Paris

MATERIAL EXAMINED. — **Indonesia**. *"Snellius"* II: stn 4.155, 06°22' S, 120°26' E, 233-274 m, 1 lv.
Philippines. MUSORSTOM 3: stn CP 139, 11°53' N, 122°14' E, 240-267 m, 1 lv, 6 dd.

DISTRIBUTION. — Gulf of Tonking, now extended to the Philippines and Indonesia. Alive from 72 m (CHISTIKOV, 1979b) to ca. 270 m (present paper).

Family LAEVIDENTALIIDAE Palmer, 1974

Genus *LAEVIDENTALIUM* Cossmann, 1888

Type species (OD): *Dentalium incertum* Deshayes, 1825. Eocene, France.

DIAGNOSIS. — *Shell* medium to large, slightly to well curved, thin but not fragile, shiny, translucent white to cream. Sculpture usually fine longitudinal undulations and conspicuous growth lines; in some species, slight swellings at regular intervals. Apex simple or with terminal callus and projectig pipe cylindrical or fissured, lumen distinct. Section circular to subcircular.
Radula rachidian very slightly curved at central portion in transverse section; an irregular zone is present in the center; in frontal view, the anterior margin is irregular with a high central projection. Lateral head not well differentiated, no cusps, anterior margin finely undulated or granulose; marginal long, slightly sinusoidal.

DISTRIBUTION. — Triassic-Recent, worldwide, sublittoral-bathyal.

Laevidentalium eburneum (Linné, 1767)

Figs 96, 102 a

Dentalium eburneum Linné, 1767: 1264.

Synonyms:

Dentalium indicum Chenu, 1843: 1, pl. 3, fig. 11.
Dentalium philippinarum Sowerby, 1860: 98, pl 225 (*Dentalium* 3), fig. 54.

Other references:

Dentalium eburneum — GMELIN, 1791: 3737. — SOWERBY, 1860: 98, pl. 225 (*Dentalium* 3), fig. 53; 1873: pl. 3, fig. 16. — MARTENS, 1887: 200. — PILSBRY & SHARP, 1897: 115, pl. 20, figs 33-34. — SMITH, 1906a: 250. — BOISSEVAIN, 1906: 52, pl. 2, fig. 31, pl. 4, figs 10-11. — HEDLEY, 1916: 223. — WINCKWORTH, 1940a: 25. — DAWIDOFF, 1952: 144. — ROBERTS, SOEMODIHARDJO & KASTORO, 1982: 99.
Calliodentalium eburneum — CHISTIKOV, 1979: 112.
Laevidentalium eburneum — HABE & KOSUGE, 1964: 7.
Dentalium philippinarum — SOWERBY, 1872: pl 3, fig. 18. — PILSBRY & SHARP, 1897: 116, pl. 20, figs 31-32. — BOISSEVAIN, 1906: 53. — HABE, 1963: 269, pl. 38, fig. 33; 1964a: 34, pl. 2, fig. 33.
Laevidentalium philippinarum — HIGO & GOTO, 1993: 687.

TYPE MATERIAL. — *D. eburneum*: depository not located. — *D. indicum*: depository not located. — *D. philippinarum*: depository not located.

TYPE LOCALITY. — *D. eburneum*: India. — *D. indicum*: Indian Ocean. — *D. philippinarum*: Island of Samar, Philippines.

MATERIAL EXAMINED. — **Indonesia**. CORINDON: stn B 202, 01°11' S, 117°06' E, 27 m, 7 dd. — Stn CH 205, 01°08' S, 117°19' E, 49 m, 1 dd. — Stn B 207, 00°15' S, 117°52' E, 150 m, 1 lv, 1 dd. — Stn DR 216, 00°04' N, 117°51' E, 96 m, 1 dd. — Stn B 251, 00°54' S, 119°30' E, 65 m, 2 dd. —

Source : MNHN, Paris

Stn B 253, 00°54′ S, 119°30′ E, 17 m, 15 dd. — Stn DG 254, 00°58′ S, 119°29′ E, 53-62 m, 1 lv. — Stn DG 258, 01°57′ S, 119°17′ E, 30 m, 1 dd. — Stn B 268, 01°57′ S, 119°16′ E, 200 m, 1 lv, 1 dd.
Philippines. MUSORSTOM 2: stn DR 33, 13°32′ N, 121°07′ E, 130-137 m, 2 dd.
MUSORSTOM 3: stn DR 140, 11°43′ N, 122°34′ E, 93-99 m, 18 dd. — Stn CP 141, 11°45′ N, 122°44′ E, 44 m, 1 lv.

FIG. 96. — Distribution of *Laevidentalium eburneum*.

DISTRIBUTION. — Indian Ocean, China Seas, 75 m (DAWIDOFF, 1952), Malaya, Indonesia, Thailand, Philippines, 10-100 m (HABE & KOSUGE, 1964). Live records from 44 to 200 m (present paper).

Laevidentalium leptosceles (Watson, 1879)

Figs 97, 102 b

Dentalium leptosceles Watson, 1879: 513.

Synonym:
Dentalium banale Boissevain, 1906: 55, pl. 6, fig. 30 (**Syn. nov.**).

Other references:
Dentalium leptosceles — PILSBRY & SHARP, 1897: 110, pl. 3, figs 44-46.
Dentalium leptosceles (?) (sic) — LUDBROOK, 1954: 104, fig. 6.
Dentalium leptoskeles (injustified emendation) — WATSON, 1886: 7, pl. 1, fig. 6.
Laevidentalium banale — HABE & KOSUGE, 1964: 7.

TYPE MATERIAL. — *D. leptosceles*: holotype BMNH 1887.2.9.21. — *D. banale*: holotype ZMA 3.06.068.69.

TYPE LOCALITY. — *D. leptosceles*: S. of Australia, *"Challenger"*, stn 160, 42°42′ S, 134°10′ E, 2600 fms [4758 m]. — *D. banale*: Indonesia, Timor Sea, *"Siboga"*, stn 300, 10°49′ S, 123°23′ E, 918 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOCAL: stn DS 59, 23°56′ S, 166°41′ E, 2650 m, 1 lv.

Source : MNHN, Paris

BIOGEOCAL: stn CP 250, 21°25′ S, 166°26′ E, 2350 m, 1 dd. — Stn KG 276, 21°13′ S, 167°00′ E, 2200 m, 1 lv.
Tasman Sea. *"Galathea"*: stn 574, 39°45′ S, 159°39′ E, 4680-4730 m, 1 dd.
Indian Ocean. SAFARI 1: stn DS 05, 30°37′ S, 48°30′ E, 4500-4612 m, 2 lv. — Stn CP 06, 30°40′ S, 48°14′ E, 4020-4035 m, 1 lv, 1 dd. — Stn CP 09, 30°49′ S, 49°08′ E, 4589-4730 m, 3 lv, 3 dd. — Stn CP 17, 24°26′ S, 58°19′ E, 4987-5025 m, 1 lv. — Stn SIPAN 7909, 30°41′ S, 48°28′ E, 4462 m, 1 dd. SAFARI 2: stn CP 13, 04°30′ S, 86°55′ E, 4950 m, 1 dd. — Stn CP 18, 06°02′ S, 79°32′ E, 5175 m, 1 lv. — Stn CP 29, 12°57′ S, 79°37′ E, 4928-4950 m, 1 dd. — Stn CP 31, 13°45′ S, 76°56′ E, 5300 m, 1 lv, 2 dd.
"Galathea": stn 194, 34°09′ S, 30°45′ E, 4360 m, 1 dd. — Stn 234, 05°25′ S, 47°09′ E, 4830 m, 1 dd.

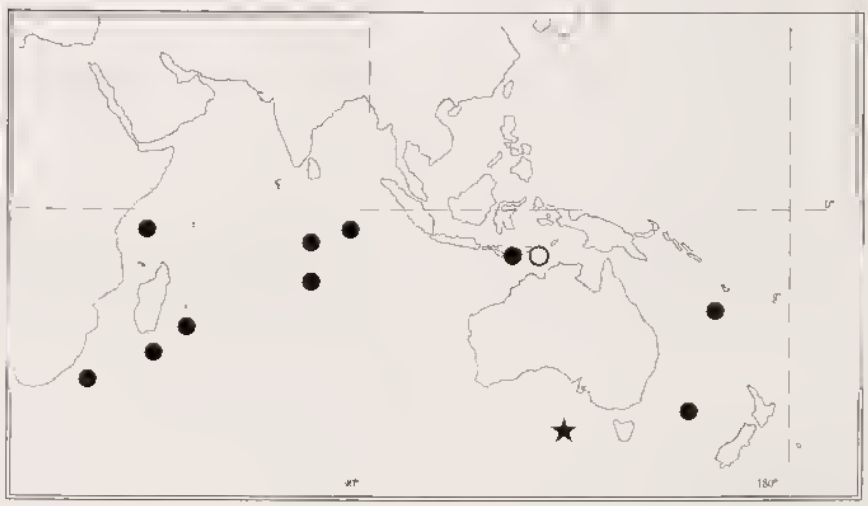


FIG. 97. — Distribution of *Laevidentalium leptosceles*.

DISTRIBUTION. — Widely distributed at bathyal and abyssal depths in the Indian Ocean, Timor Sea, Tasman Sea and New Caledonia. Recorded alive between 2200 and 5300 m (present paper). Shells from 918 m (BOISSEVAIN, 1906, under *D. banale*).

Laevidentalium coruscum (Pilsbry, 1905)

Figs 98, 102 c, f

Dentalium (*Laevidentalium*) *coruscum* Pilsbry, 1905:117, pl. 5, figs 42-43.

Other references:

Dentalium (*Laevidentalium*) *coruscum* — KURODA & KIKUCHI, 1933: 10, pl. 1, fig. 7.
Laevidentalium coruscum — HABE, 1963: 268, pl. 38, figs 15, 29.
Gadilina coruscum — HABE, 1964a: 32, pl. 2, figs 15, 26, 29.

TYPE MATERIAL. — Syntype ANSP.

TYPE LOCALITY. — Heda, Izu, Japan, 306 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DC 376, 19°51′ S, 158°30′ E, 280 m, 1 dd.
Indonesia. *"Snellius"* II: stn 4.127, 08°19′ S, 118°18′ E, 500-550 m, 1 dd. — Stn 4.267, 08°18′ S, 118°21′ E, 650 m, 2 dd.

Source : MNHN, Paris

Philippines. MUSORSTOM 2: stn CP 66, 14°01′ N, 120°20′ E, 192-209 m, 1 lv, 1 dd. — Stn CP 75, 13°50′ N, 120°30′ E, 300-330 m, 3 lv, 3 dd. — Stn CP 78, 13°49′ N, 120°28′ E, 441-550 m, 1 lv, 19 dd.
MUSORSTOM 3: stn CP 99, 14°01′ N, 120°19′ E, 196-204 m, 1 dd. — Stn CP 119, 12°00′ N, 121°13′ E, 320-337 m, 4 dd. — Stn CP 139, 11°53′ N, 122°15′ E, 240-267 m, 5 dd.

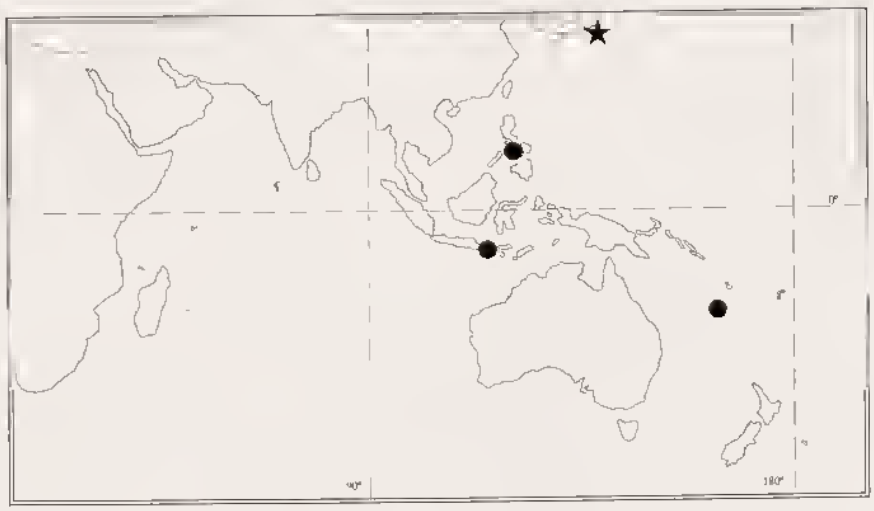


FIG. 98. — Distribution of *Laevidentalium coruscum*.

DISTRIBUTION. — Japan and Indonesia (HABE, 1964) now extended to the Philippines and New Caledonia. Alive in 192-550 m.

REMARKS. — *Laevidentalium coruscum* resembles *L. eburneum*, but it is white, shiny, more slender and possesses apical callus.

Laevidentalium gofasi sp. nov.

Figs 99, 102 e

TYPE MATERIAL. — Holotype MNHN. Paratypes: 8 MNHN, 1 AMS C201728, 1 USNM.

TYPE LOCALITY. — Philippines, MUSORSTOM 2, stn CP 70, 14°01′ N, 120°17′ E, 191 m.

MATERIAL EXAMINED. — **Loyalty Islands**. MUSORSTOM 6: stn DW 481, 21°22′ S, 167°50′ E, 300 m, 1 lv.
Philippines. MUSORSTOM 2: stn CP 20, 14°00′ N, 120°18′ E, 185-192 m, 1 dd (paratype USNM). — Stn CP 68, 14°01′ N, 120°18′ E, 195-199 m, 2 lv (paratypes). — Stn CP 70, 14°01′ N, 120°17′ E, 191 m, 2 dd (holotype and paratype). — Stn CP 83, 13°55′ N, 120°30′ E, 318-320 m, 1 lv (paratype).
MUSORSTOM 3: stn CP 96, 14°00′ N, 120°18′ E, 190-194 m, 1 dd (paratype AMS). — Stn CP 97, 14°00′ N, 120°18′ E, 189-194 m, 1 dd (paratype). — Stn CP 102, 14°01′ N, 120°18′ E, 192 m, 3 dd (paratypes).

DISTRIBUTION. — The Philippines and New Caledonia, live records from 195 to 320 m.

Source : MNHN, Paris

FIG. 99. — Distribution of *Laevidentalium gofasi*.

DESCRIPTION. — *Shell* to 80 mm long, slender, chalky-white, slightly translucent, polished, moderately to well curved (2 to 6 mm for 27-56 mm length). Surface and sides irregular due to encircling wrinkles of varying size and position, prominent growth lines with associated white bands and longitudinal threads, apparent under magnification, more conspicuous on dorsal side. Section oval, slightly laterally compressed. Apex truncate, simple, strong.

Measurements: holotype L 50, W 1.9-1.7, w 0.53-0.50, arc 6; paratypes L 51.3, W 1.9-1.8, w 0.52-0.50, arc 4.5; L 38.6, W 1.7-1.6, w 0.4-0.3, arc 4; L 56.5, W 1.8-1.7, w 0.6-0.5, arc 6; L 73.5, W 2.7-2.6, w 0.7-0.6, arc 4; L 44, W 1.7-1.6, w 0.6-0.52, arc 2.5. W/w ratio 2.8-4.2.

REMARKS. — Compared with *Laevidentalium houbricki*, *L. gofasi* is stronger, has slightly oval section and longitudinal sculpture.

ETYMOLOGY. — Named for Dr Serge GOFAS, MNHN.

Laevidentalium houbricki sp. nov.

Figs 100, 102 d

TYPE MATERIAL. — Holotype MNHN. Paratypes: 7 MNHN, 1 AMS C201729, 1 NMNZ M268955, 1 USNM.

TYPE LOCALITY. — New Caledonia, Poindimié area, LAGON, stn 835, 20°47′ S, 165°17′ E, 135-150 m.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 835, 20°47′ S, 165°17′ E, 135-150 m, 1 lv (holotype), 2 dd (paratypes). — Stn 858, 20°37′ S, 165°07′ E, 220 m, 10 lv (8 paratypes: 5 MNHN, 1 AMS, 1 NMNZ, 1 USNM).
Passe de Boulari, B. Richer/ORSTOM coll., 400 m, 7 dd.
Indonesia. CORINDON: stn CH 208, 00°15′ S, 117°52′ E, 150 m, 1 dd.

DISTRIBUTION. — Makassar Strait, Indonesia, and New Caledonia, live records in 135-220 m.

DESCRIPTION. — *Shell* to 67 mm, slender, solid, white, polished, very slightly curved. Transversal sculpture consisting of close lines probably corresponding to growth periods. Longitudinal sculpture of undulating threads throughout, observable under magnification. Section slightly compressed laterally. Apex truncate, without notch, strongly walled, lumen circular. Mouth straight.

Measurements: holotype L 60, W 2.3, w 0.8, arc 0.8; paratypes L 66.6, W 2.4, w 0.7, arc 1.2; L 34.6, W 1.8, w 0.6, arc 1. W/w ratio 2.9-3.4.

Source : MNHN, Paris

FIG. 100. — Distribution of *Laevidentalium houbricki*.

ETYMOLOGY. — Named for the late Dr Richard S. HOUBRICK, USNM, Smithsonian Institution.

Other Indo-Pacific species of *Laevidentalium* cited in the literature

Laevidentalium bisinuatum (André, 1896): 397, pl. 17, fig. 9a-c. Amboyna [= Ambon], Indonesia. Holotype MHNG 1155/40. Generic allocation uncertain.
Laevidentalium pluteum Colman, 1958: 143, fig. 8. Off Willongong, New South Wales, Australia, 183 m. Holotype AMS C18217. Generic allocation uncertain.
Laevidentalium sominium Okutani, 1964: 75, fig. 3. Sagami Bay, Japan, 1320-1400 m.
Laevidentalium toyamense (Kuroda & Kikuchi, 1933): 11, pl. 1, figs 5-6. Toyama Bay, Honshu, Japan, 200 m.

Family OMNIGLYPTIDAE Chistikov, 1975

Genus *OMNIGLYPTA* Kuroda & Habe *in* Habe, 1953

Type species (OD): *Dentalium cerinum* Pilsbry, 1905.

DIAGNOSIS. — *Shell* large, slightly curved, narrow, fragile, translucent, light orange in fresh specimens, cream when eroded. Sculptured with close, fine, regularly spaced encircling wrinkles throughout. Apex simple, section circular.
Radula rachidian slightly curved in section, anterior margin and internal face with irregular projections; lateral irregular, head poorly defined, cusp flat, anterior margin finely undulated; marginal long; nearly straight.

DISTRIBUTION. — Recent, West Pacific and Indian Oceans, absent in the Atlantic Ocean. Shelf-abyssal.

Source : MNHN, Paris

Omniglypta cerina (Pilsbry, 1905)

Figs 101, 102 g-h

Dentalium (Rhabdus) cerinum Pilsbry, 1905: 117, pl. 5, figs 40-41.

Synonym:

Dentalium tracheatum Boissevain, 1906: 56, pl. 4, fig. 22 (**Syn. nov.**).

Other references:

Omniglypta cerina – Habe, 1953: 296, figs 753-754; 1955: 24, figs 1-2; 1962: 106, pl. 47, fig. 13; 1963: 270, textfigs 23-24; 1964a: 37, pl. 4, figs 23-24; 1971: 492 (Japanese text): 310 (English text), pl. 65, figs 24-25; 1977: 337, pl. 70, figs 5-6, pl. 72, fig. 9. — Habe & Kosuge, 1964: 7. — Okutani, 1983: 12, pl. 43, fig. 14. — Habe *et al.*, 1986: 24. — Higo & Goto, 1993: 688.
Dentalium (*Rhabdus*) *cerinum* – Clench & Turner, 1962: 29.
Dentalium (*Plagioglypta*) *tracheatum* – Plate, 1908a: 357.

Type material. — *D. cerinum*: holotype ANSP 88305. — *D. tracheatum*: lectotype (here designated) the specimen illustrated by Boissevain (1906), ZMA 3.06.076, paralectotypes ZMA 3.06.075, 077-080.

Type locality. — *D. cerinum*: Shimizu, Suruga Bay, Japan. — *D. tracheatum*: Indonesia, Banda Sea, "*Siboga*", stn 208, 05°39' S, 122°12' E, 1886 m.

Material examined. — The type material.
Indonesia. "*Snellius*" II: stn 4.130, 08°18' S, 118°18' E, 700-730 m, (dd). — Stn 4.131, 08°18' S, 118°18' E, 680-800 m, 6 dd.
Philippines. ESTASE 2: stn CP 6, 04°38' N, 119°49' E, 2570 m, 2 dd. — Stn DR 5, 04°58' N, 125°19' E, 3925 m, 1 lv.
MUSORSTOM 3: stn DR 115, 12°32' N, 120°44' E, 794 m, 1 lv.

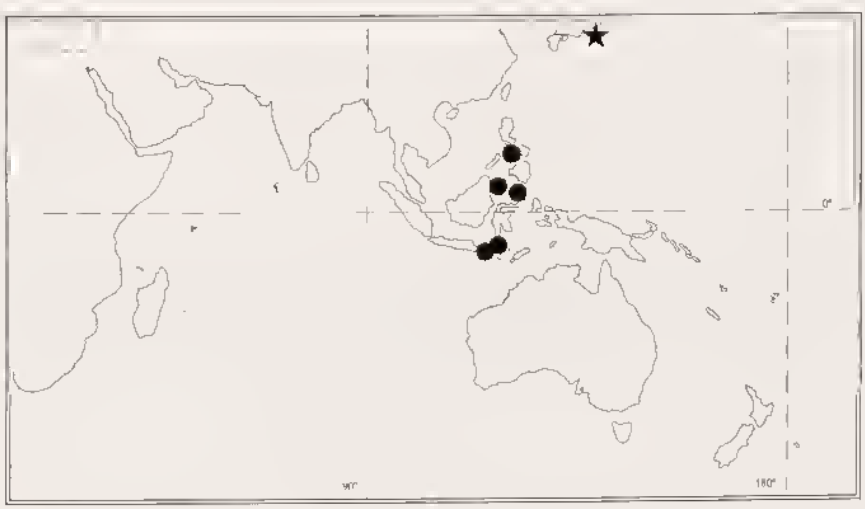


Fig. 101. — Distribution of *Omniglypta cerina*.

Distribution. — Japan and Indonesia, now the Philippines. Habe & Kosuge (1964) give the depth range as 0-1886 m, but this species appears clearly to be a deep-water species, with live records in 800-3925 m (present paper).

Source : MNHN, Paris

Family RHABDIDAE Chistikov, 1975

Genus *RHABDUS* Pilsbry & Sharp, 1897

Figs 102 i-j

Type species (OD): *Dentalium rectius* Carpenter, 1864. Recent, Northeastern Pacific.

DIAGNOSIS. — *Shell* medium to large, almost sraight, fragile, translucent. Sculpture lacking, cross section circular, apex and mouth simple. The pavilion secretes a secondary tube that cannot be distinguished from the primary shell. The annular ciliary organ of the anterior mantle margin is lacking. Instead, a pair of dorsolateral slits with ciliated walls is present. Bundles of longitudinal pedal muscles keep the pedal ganglia in position. The ligament of the buccal septum is missing (STEINER, 1992a).
Radula rachidian slightly curved in section, anterior border irregular, with a prominent central projection and two projections at each side that not reach the border; laterals with wide granulose head, prominent cusp and wrinckles instead of denticles; marginals almost straight.

DISTRIBUTION. — Worldwide, temperate to cold waters, shelf-bathyal.

The genus *Rhabdus* is not represented in the material reported on here.

Order GADILIDA Starobogatov, 1974

Suborder ENTALIMORPHA Steiner, 1992

Family ENTALINIDAE Chistikov, 1979

Subfamily ENTALININAE Chistikov, 1979

Genus *ENTALINA* Monterosato, 1872

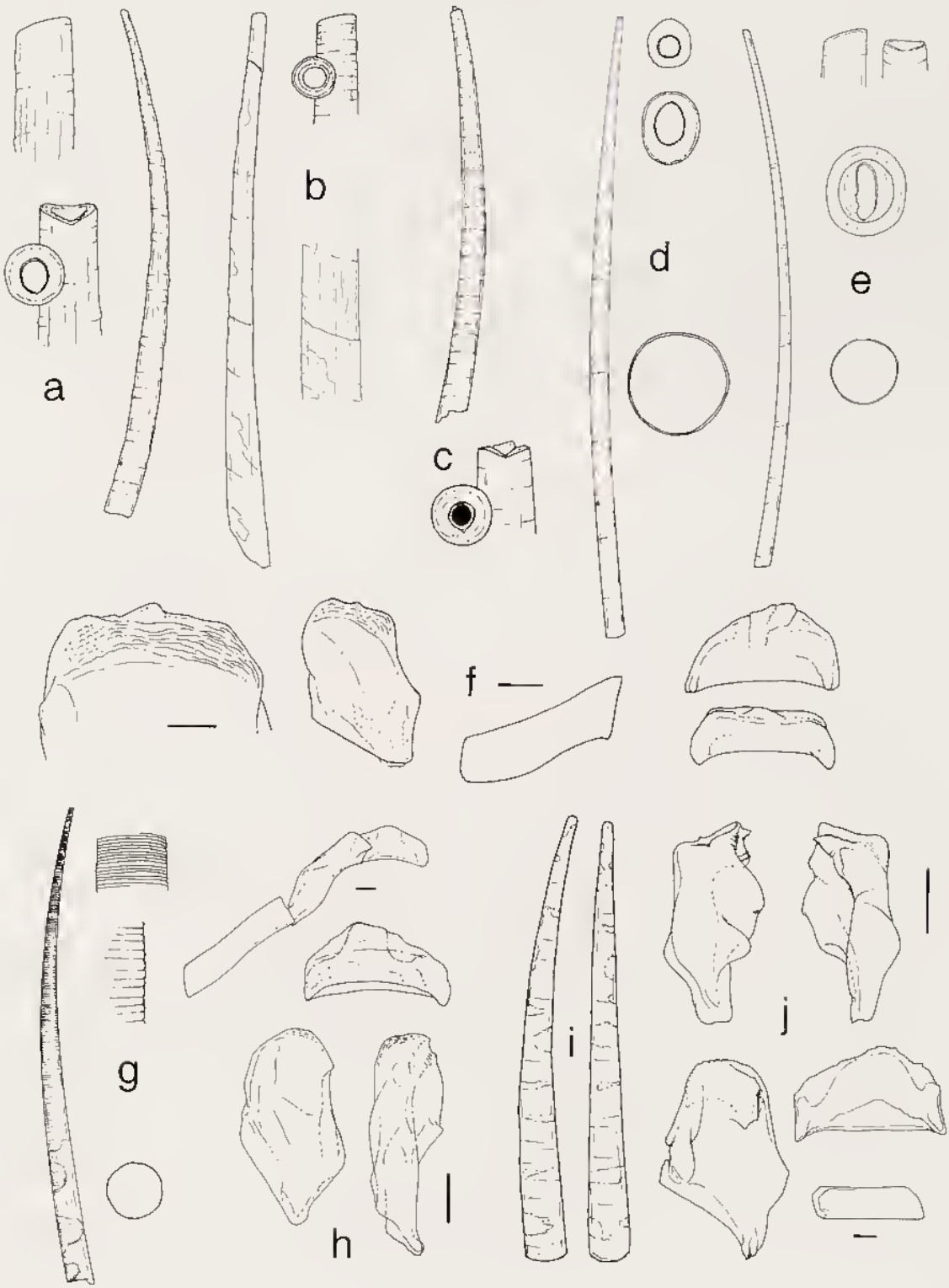
Type species (OD): *Dentalium tetragonum* Brocchi, 1814. Miocene. Italy.

DIAGNOSIS. — *Shell* medium to large, arched, solid, usually polished, translucent white when fresh, chalky when dead. Sculptured by 4-5 primary ribs, secondary riblets present. Rib section flat to rounded, simple or bifurcated. Intercostal spaces straight to convex, smooth or longitudinally sculptured. Apex simple. Section usually pentagonal at the apex; pentagonal or quadrate at mouth. *Radula* rachidian high, narrow, anterior margin usually rounded, but occasionally irregular; lateral high, with two lateral primary cusps, lateral denticles present, including 5-6 subequal secundary denticles; marginal sinusoidal.

DISTRIBUTION. — Miocene-Recent. Worldwide. Sublittoral-bathyal.

FIG. 102. — **a**, *Laevidentalium eburneum*, shell (58 mm), apex and apical section, CORINDON: stn DG 258. — **b**, *Laevidentalium leptosceles*, shell (33 mm), apex and apical section, detail of sculpture, SAFARI: stn CP 09. — **c**, *Laevidentalium eoruseum*, shell (43 mm), apex and apical section, MUSORSTOM 3: stn CP 139 . — **d**, *Laevidentalium houbricki* sp. nov., holotype, shell (60 mm), apical, posterior 1/4 and oral sections. — **e**, *Laevidentalium gofasi* sp. nov., holotype, shell (50 mm), apex, apical and oral sections. — **f**, *Laevidentalium* type radula (*L. eoruseum*). — **g**, *Omniglypta eerina*, shell (62 mm), detail of sculpture and oral section, ESTASE 2: stn CP 6. — **h**, *Omniglypta* type radula (*O. cerina*). — **i**, *Rhabdus perceptum*, (Southern Argentina; Montevideo Museum), shell (60 mm), lateral and dorsal views. — **j**, *Rhabdus* type radula (*R. perceptum*).

Source : MNHN, Paris



Source : MNHN, Paris

Entalina mirifica (Smith, 1895)

Figs 103, 107 a, c

Dentalium mirificum Smith, 1895: 9, pl. 2, fig. 1.

Synonyms:

Entalina quadrangularis Boissevain, 1906: 62, pl. 6, figs 73-75, 85-86 (**Syn. nov.**).
Entalina majestica Kira, 1959: 105, pl. 40, fig. 3.

Other references:

Dentalium mirificum – Winckworth, 1940a: 25.
Entalina mirifica – Pilsbry & Sharp, 1897: 134, pl. 20, fig. 29. — Boissevain, 1906: 62, pl. 2, fig. 37. — Ludbrook, 1954: 111, fig. 15. — Chistikov, 1982c: 1496, pl. 2, figs 2-3.
Entalina (E.) mirifica – Habe & Kosuge, 1964: 8.
Entalina quadrangularis – Plate, 1908a: 358. — Habe, 1964a: 39, pl. 3, fig. 6, pl. 4, figs 20-21. — Okutani, 1966: 13. — Habe, 1977: 339, pl. 71, figs 1-2. — Chistikov, 1982c: 1496. — Habe *et al.*, 1986: 24. — Higo & Goto, 1993: 689.
Entalina (E.) quadrangularis – Habe, 1964b: 8.
Entalina platamodes – Boissevain, 1906: 62, pl. 2, fig. 38, pl. 6, figs 76-78.
Entalina quadriangularis (*sic*) – Habe, 1963: 271, textfigs 20-21. — Okutani, 1964: 78, pl. 6, fig. 5; 1966: 13.

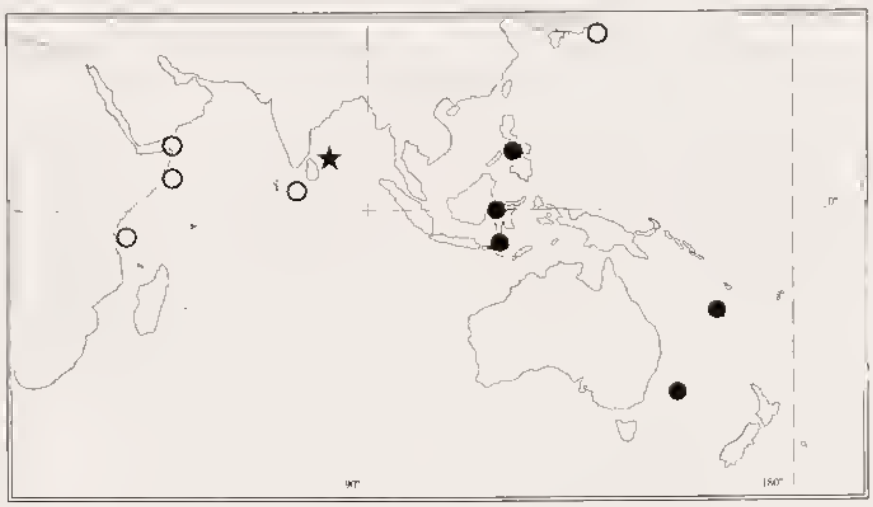


Fig. 103. — Distribution of *Entalina mirifica*.

Type material. — *D. mirificum*: 4 syntypes dd BMNH 1895.7.2.26. — *E. quadrangularis*: lectotype (here designated) ZMA 3.06.081 and paralectotypes ZMA 3.06.082.083.

Type locality. — *D. mirificum:* Indian Ocean, off Trincomalee, *"Investigator"*, stn 172, 200-350 fms [357-640 m]. — *E. quadrangularis*: Indonesia, Celebes Sea, *"Siboga"*, stn 88, 00°35′ N, 119°09′ E, 1301 m. — *E. majestica*: Japan, 30-50 fms [55-91 m].

Material examined. — The type material listed above.
New Caledonia. BIOGEOCAL: stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 1 dd.
"Vauban" 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 7 lv, 10 dd.
Tasman Sea. *"Galathea"*: stn 554, 37°28′ S, 151°51′ E, 1330 m, 5 lv, 4 dd.
Indonesia. CORINDON: stn B 236, 00°07′ N, 119°45′ E, 173 m, 2 dd.
"Snellius" II: stn 4.112, 08°19′ S, 118°16′ E, 365 m, 5 dd. — Stn 4.128, 08°18′ S, 118°16′ E, 700-835 m, 1 dd. — Stn 4.130, 08°18′ S, 118°18′ E, 700-730 m, 1 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 680-800 m, 4 dd.

Source : MNHN, Paris

Philippines. ESTASE 2: stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 8 lv, 4 dd.
MUSORSTOM 2: stn CP 18, 14°00′ N, 120°18′ E, 188-195 m, 1 lv, 1 dd. — Stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 1 lv. — Stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 2 lv, 2 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 2 lv, 5 dd.
MUSORSTOM 3: stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 2 dd. — Stn CP 118, 11°58′ N, 121°06′ E, 448-466 m, 1 dd.

DISTRIBUTION. — Indonesia (BOISSEVAIN, 1906), Northern Indian Ocean, 55-1300 m (HABE & KOSUGE, 1964 as *E. quadrangularis*) as far West as Zanzibar and the Gulf of Aden (LUDBROOK, 1954). Now extended to the Philippines and the South Pacific, live records in 195 — 2050 m.

REMARKS. — The shape of the oral section was the considered the main difference between *Entalina mirifica* and *E. quadrangularis*. When a large series of individuals is examined, the variability of this character indicates the weakness of the former specific distinction. I agree with Japanese authors in considering *E. majestica* also a junior synonym of *E. quadrangularis*.

Entalina subterlineata (Tomlin, 1931)

Figs 104, 107 b

Deutalium subterlineatum Tomlin, 1931: 337.

Other references:

Deutalium subterlineatum — BARNARD, 1963b: 348, fig. 30a.
Entalina subterlineata — CHISTIKOV, 1982c: 1497.

TYPE MATERIAL. — Holotype SAM A6192, paratype NMW (*fide* OLIVER, 1984).

TYPE LOCALITY. — Off South Africa, "Cape Point 17°85′ E, 43 mi, 900 fms" [1645 m].

MATERIAL EXAMINED. — The holotype.
South Africa. *"Meiring Naudé"*: stn SM 94, 28°16′ S, 32°29′ E, 670 m, 2 dd. — Stn SM 123, 30°33′ S, 30°49′ E, 690 m, 2 lv. — Stn SM 129, 30°53′ S, 32°31′ E, 850 m, 16 lv, 20 dd. — Stn SM 131, 30°43′ S, 30°40′ E, 780 m, 1 dd. — Stn SM 184, 33°39′ S, 27°11′ E, 86 m, 6 lv. 10 dd.

FIG. 104. — Distribution of *Entalina subterlineata*.

Source : MNHN, Paris

DISTRIBUTION. — Endemic to South Africa, recorded alive from 690-860 m, shells down 1645 m.

Other Indo-Pacific species of *Entalina* cited in the literature

Entalina adenensis Ludbrook, 1954: 112, fig. 17. Gulf of Aden, *"John Murray"*, stn 185, 13°48′ N, 16°48′ E, 2000 m. Supposedly in BMNH, not located.

Entalina inaequisculpta Ludbrook, 1954: 111, fig. 16. Gulf of Aden, *"John Murray"*, stn 185, 13°48′ N, 16°48′ E, 2000 m. Supposedly in BMNH, not located.

Subfamily HETEROSCHISMOIDINAE Chistikov, 1982

Genus *HETEROSCHISMOIDES* Ludbrook, 1960

Figs 107 d-e

Type species (OD): *Dentalium subterfissum* Jeffreys, 1877. Recent, North Atlantic Ocean.

DIAGNOSIS. — *Shell* medium, slightly curved, regularly tapering, translucent when fresh, milky-white when dead. Longitudinal sculpture of 10-12 primary prominent ribs, intercostal spaces convex. Apex with a deep irregular fissure on dorsal side. Section polygonal, slightly compressed laterally, oral aperture thin.

Radula rachidian with anterior margin rounded and lateral half folded to the ventral side; lateral with sharp pointed primary cusps and 4 important denticles; marginal slightly curved with conspicuous lateral processus.

DISTRIBUTION. — Recent, North Atlantic Ocean, bathyal-abyssal.

REMARKS. — As in *Spadentalina*, the fissure is observed since the embryonic stage of the shell (Fig. 111 g).

The genus *Heteroschismoides* has not been found in the Indo-Pacific region.

Genus *COSTENTALINA* Chistikov, 1982

Type species (OD): *C. elegans* Chistikov, 1982. Recent, Indian Ocean.

DIAGNOSIS. — *Shell* small to medium, slightly to well curved, fragile, translucent white when fresh, opaque to polished when dead. Longitudinal sculpture of 10-12 prominent primary ribs; intercostal spaces convex. Apex simple, truncate, irregular, preapical callus prominent, lumen circular. Section polygonal, oral aperture thin.

Radula rachidian high, polygonal with rounded anterior margin and lateral half folded to ventral side; lateral well armed, with sharp, pointed primary cusps; marginal slightly curved (Fig. 107 h: *C. vemae* Scarabino, 1986).

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Source : MNHN, Paris

Costentalina tuscarorae Chistikov, 1982

Figs 105, 107 f, 111 h, k

Costentalina tuscarorae Chistikov, 1982b: 1316, pl. 1, figs 7-11, pl. 4, figs 1-2.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV, 1982).

TYPE LOCALITY. — NW Pacific, *"Vitiaz"*, stn 3575, 38°02'1 N, 146°33'1 E, 5475 m.

MATERIAL EXAMINED. — **Philippines**. ESTASE 2: stn CP 2, 14°05' N, 120°02' E, 2050 m, 3 lv, 2 dd. — Stn DW 1, 14°05' N, 120°01' E, 2200 m, 2 lv, 2 dd.

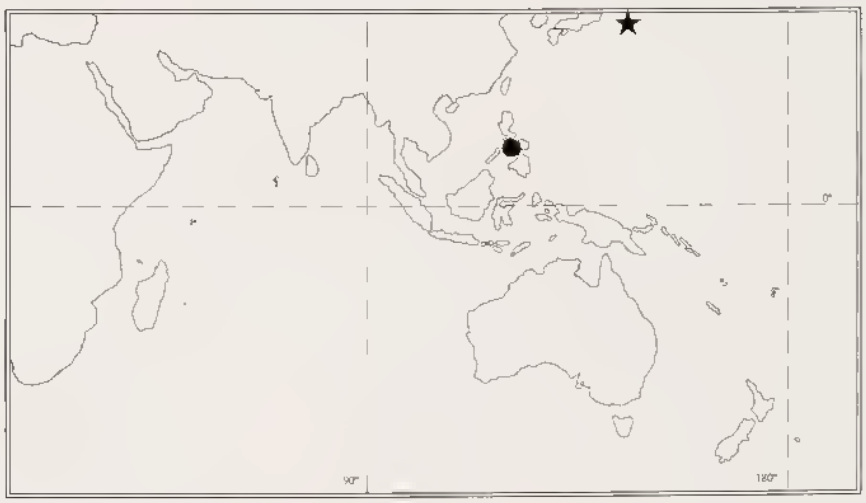


FIG. 105. — Distribution of *Costentalina tuscarorae*.

DISTRIBUTION. — East of Japan and the Philippines. Live records from 2050 m (present paper) to 5475 m (CHISTIKOV, 1982).

Costentalina indica Chistikov, 1982

Figs 106, 107 g

Costentalina indica Chistikov, 1982b: 1318, pl. 1, figs 12-14, pl. 4, figs 4-7.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV, 1982).

TYPE LOCALITY. — Indian Ocean, *"Vitiaz"*, stn 4922, 06°54'2 S, 83°00'7 E, 3980 m.

MATERIAL EXAMINED. — **West Indian Ocean.** BENTHEDI: stn CH 87, 11°44' S, 47°35' E, 3716 m, 8 lv, 5 dd. — Stn CH 90, 11°44' S, 47°30' E, 3700 m, 2 lv.
MD 32 Réunion: stn DS 149, 20°26' S, 55°40' E, 3500-3510 m, 2 lv, 2 dd. — Stn DS 151, 20°51' S, 56°03' E, 3240-3300 m, 4 lv.

Source : MNHN, Paris

SAFARI 1: stn CP 06, 30°40′ S, 48°14′ E, 4020-4035 m, 1 lv. — Stn DS 05, 30°37′ S, 48°30′ E, 4500-4612 m, 2 lv. — Stn DS 08, 24°22′ S, 58°19′ E, 5025-5825 m, 1 lv. — Stn SIPAN 79 09, 30°41′ S, 48°28′ E, 4462 m, 1 lv. — Stn CP 17, 24°26′ S, 58°19′ E, 4987-5025 m, 1 lv.

FIG. 106. — Distribution of *Costentalina indica*.

DISTRIBUTION. — Central Indian Ocean, SE of Sri Lanka, Madagascar and Réunion Island. Live records from 3240 to 5285 m (present paper).

Other Indo-Pacific species of *Costentalina* cited in the literature

Costentalina elegans Chistikov, 1982. Indian Ocean, *"Vitiaz"*, stn 6744-5 T, 12°47′ S, 88°54′ E, 5100-5200 m, ZIN.

Genus *ENTALINOPSIS* Habe, 1957

Type species (OD): *Dentalium nivosum* Kuroda & Kikuchi, 1933 [= *Dentalium intercostatum* Boissevain, 1906].

DIAGNOSIS. — *Shell* medium to large, slightly curved, to nearly straight, solid, opaque or polished, chalky white. Longitudinal sculpture of 7 angled primary ribs, one ventral; intercostal spaces convex. Apex simple, with crownlike appearance in fresh specimens due to projection of the primary ribs. Preapical callus prominent, lumen circular. Starlike in section.
Radula rachidian subpyramidal, anterior border rounded, base wide; lateral with one prominent primary cusp and secondary denticles, base wide; marginal long, slightly sigmoidal.

DISTRIBUTION. — Recent, West Pacific and Indian Oceans, absent in the Atlantic. Shelf, bathyal.

Source : MNHN, Paris

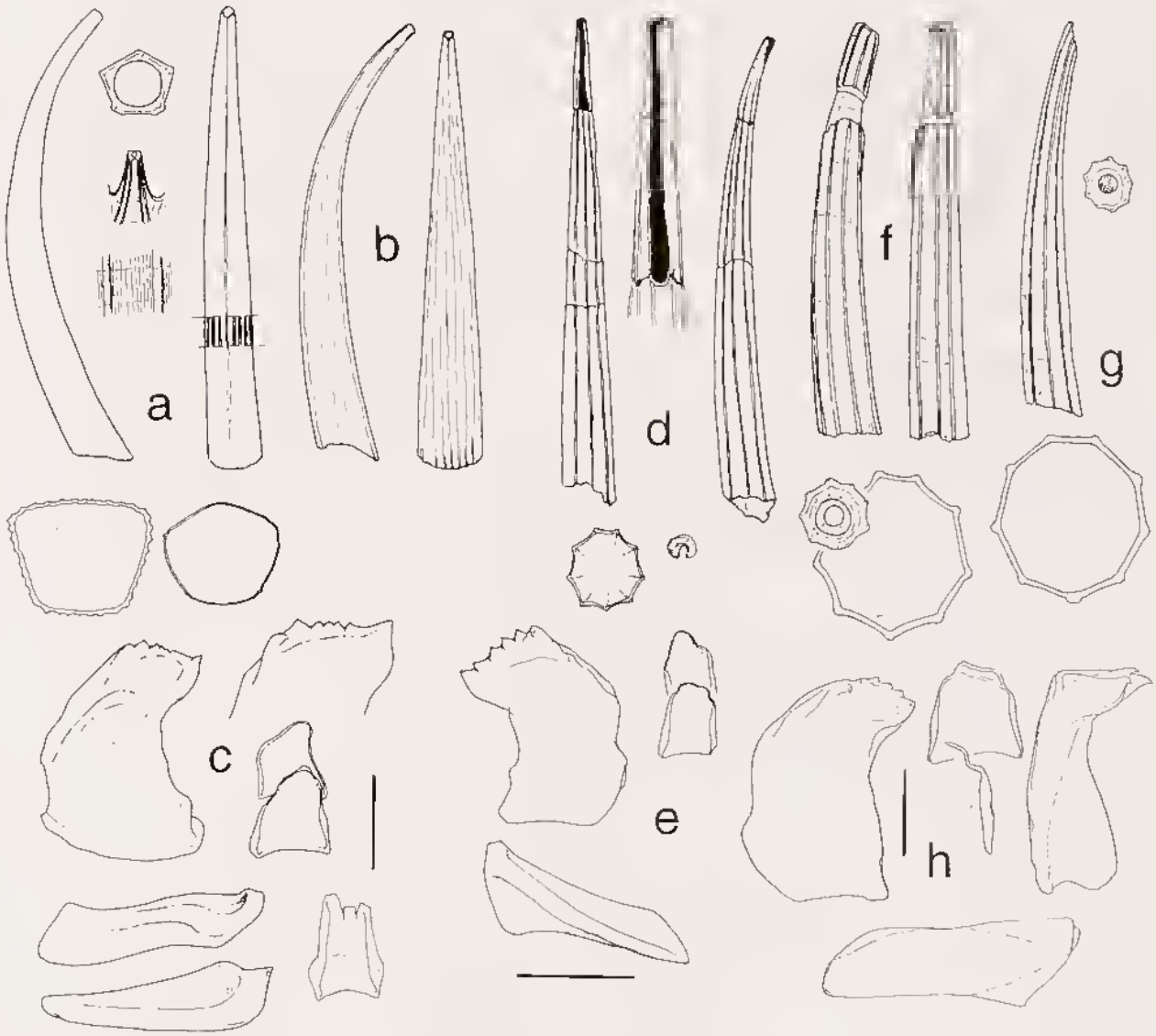


FIG. 107. — **a**, *Entalina tubifica*, shell (21 mm), ventral view of apex (note double ribs), apical section, variation of oral section, detail of sculpture, MUSORSTOM: stn CP 25 and oral section (right fig.), MUSORSTOM 2: stn CP 18 — **b**, *Entalina subterlineata*, shell (17 mm) "*Meiring Naudé*", stn SM 123. — **c**, *Entalina* type radula (*E. tubifica* and an isolated rachidian of *E. quinquangulare* [Northeastern Atlantic Ocean] bottom right). — **d**, *Heteroschismoides subterfissum* (Northeast Atlantic Ocean, Bay of Biscay, MNHN), shell (13 mm), lateral and ventral faces, apex, apical and oral sections. — **e**, *Heteroschismoides* type radula (*H. subterfissum*). — **f**, *Costentalina tuscaroraе*, shell (11 mm), lateral and dorsal faces, apical and oral sections, ESTASE 2: stn CP 2. — **g**, *Costentalina tullica*, shell (10 mm), apical and oral sections, SAFARI 1: stn DS 5. — **h**, *Costentalina* type radula (*C. venae*, Argentine basin, South Atlantic Ocean). Scale lines: 100 µm.

Entalinopsis intercostata (Boissevain, 1906)

Figs 108, 115 a, d

Dentalium intercostatum Boissevain, 1906: 14, pl. 6, fig. 14, textfig. 11.

Synonyms:

? Dentalium siberutense Plate, 1908a: 348, pl. 30, figs 17-20 (**Syn. nov.**).
Dentalium nitrosum Kuroda & Kikuchi, 1933: 7, pl. 1, figs 9-10, textfigs 1-2.
Dentalium tugaruense Nomura & Hatai, 1940: 73, pl. 3, fig. 4 (*fide* HABE, 1964a).

Source : MNHN, Paris

Other references:

Entalina intercostata – HABE, 1977: 339, pl. 71, figs 3-5.
Entalina (Entalinopsis) intercostata – HABE, 1963: 272, pl. 38, figs 24-25.
Entalina (Entalinopsis) nivosa – HABE, 1957: 135, fig 9.
Entalinopsis intercostatus – HABE, 1964a: 40, pl. 2, figs 24-25, pl. 5, figs 63-65; 1971: 492 (Japanese text), 310 (English text), pl. 65, figs 20-21. — HABE *et al.*, 1986: 24.
Dentalium (Entalina) intercostatum – SHIKAMA, 1964: 35, fig. 1.
Entalinopsis intercostata – HIGO & GOTO, 1993: 689.

TYPE MATERIAL. — *D. intercostatum*: holotype ZMA 3.06.010.

TYPE LOCALITY. — *D. intercostatum*: Indonesia, Ceram Sea, *"Siboga"*, stn 178, 02°40′ S, 128°37′ E, 835 m. — *D. siberutense*: Indonesia, Siberut Island, 00°39′ S, 98°52′ E, 750 m. — *D. nivosum*: Toyama Bay, Japan, 80-150 m. — *D. tugaruense*: Japan.

MATERIAL EXAMINED. — The type material listed.
Indonesia. *"Snellius"* II: stn 4.130, 08°18′ S, 118°18′ E, 700-730 m, 4 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 680-800 m, 1 dd. — Stn 4.135, 06°29′ S, 121°09′ E, 495 m, 1 lv. — Stn 4.267, 08°18′ S, 118°21′ E, 650 m, 1 dd (RMNH).
Philippines. MUSORSTOM 2: stn CP 24, 13°37′ N, 120°42′ E, 640-647 m, 2 lv, 5 dd. — Stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 82 lv, 282 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 4 dd. — Stn CP 78, 13°49′ N, 120°28′ E, 441-550 m, 1 dd.
MUSORSTOM 3: stn DR 93, 13°49′ N, 120°02′ E, 540 m, 1 dd. — Stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 lv, 5 dd. — Stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 30 lv, 43 dd.

FIG. 108. — Distribution of *Entalinopsis intercostata*.

DISTRIBUTION. — Indonesia, East China Sea, Japan and the Philippines, living from 495 to 842 m (present paper), shells from 50 m (HABE & KOSUGE, 1964).

Entalinopsis micra sp. nov.
Figs 109, 111 c-d, 115 c

TYPE MATERIAL. — Holotype and 6 paratypes dd MNHN.

TYPE LOCALITY. — S New Caledonia, *"Vauban"* 1978-79, stn 40, 22°30′ S, 166°24′ E, 250-350 m.

Source : MNHN, Paris

FIG. 109. — Distribution of *Entalinopsis micra*.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — New Caledonia. Shells only in 250-350 m.

DESCRIPTION. — *Shell* to 8 mm long, arched, fragile, translucent, cream in color. Sculpture of seven primary ribs and one to three secondary ribs, originating near the apex, less prominent at the mouth than the primary ribs. Apex fine with protuberant ribs, star-like cross section. Subapical callus fine, lumen circular. Mouth fragile, polygonal in section.

Measurements: holotype L 6.8, W 0.7, w 0.4, arc 0.5; paratypes L 7.4, W 0.6, w 0.4, arc 0.6; L 6.3, W 0.5, w 0.3, arc 0.5; L 6, W 0.5, w 0.3, arc 0.4. W/w ratio 1.8-1.6.

ETYMOLOGY. — From the Latin *micra*, very small.

Entalinopsis stellata sp. nov.

Figs 110, 111 a-b, 115 b

TYPE MATERIAL. — Holotype MNHN. Paratypes: 6 MNHN, 1 AMS C201730, 1 USNM.

TYPE LOCALITY. — Philippines, MUSORSTOM 2, stn CP 18, 14°00′ N, 120°18′ E, 188-195 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 80, 20°32′ S, 166°48′ E, 900-980 m, 1 lv, 1 dd.
Philippines. MUSORSTOM 2: stn CP 18, 14°00′ N, 120°18′ E, 188-195 m, 1 lv (holotype). — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 4 lv (paratypes: 3 MNHN, 1 AMS), 3 dd (paratypes: 2 MNHN, 1 USNM). MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd (paratype).

DISTRIBUTION. — The Philippines and New Caledonia, living depth range 195-900 m.

DESCRIPTION. — *Shell* to 26.2 mm long, regularly curved, opaque, white. Sculpture of seven prominent, raised ribs, one median on ventral side, two on dorsal one. Intercostal spaces concave with growth lines. Ribs extending over apex, which is star-like in cross section. No secondary ribs. Lumen subcircular, prominent subapical callus. Mouth fragile, polygonal in section, slightly laterally compressed.

Measurements: holotype L 22.7, W 2.3, w 0.85, arc 2; paratypes L 26.2, W 2.9-2.6, w 1.15, arc 2.5; L 20.1, W 2.45, w 1.5, arc 1.5. W/w ratio 1.6-2.7.

Source : MNHN, Paris

FIG. 110. — Distribution of *Entalinopsis stellata*.

REMARKS. — One specimen is sculptured with nine ribs (Fig. 111 a).

ETYMOLOGY. — Named for the star-shaped transverse section.

Other Indo-Pacific species of *Entalinopsis* cited in the literature

Entalinopsis habutae (Kuroda & Kikuchi, 1933): 8, pl. 1, figs 3-4, 12-13. Japan, Toyama Bay, 150-350 m. Geological Institute of Kyoto University, Japan.

Genus *SPADENTALINA* Habe, 1963

Type species (OD): *Dentalium tubiforme* Boissevain, 1906.

DIAGNOSIS. — *Shell* medium to large, slightly to well curved, solid, translucent when fresh, opaque to polished when dead, white to light brown. Longitudinally sculptured by 8 angled or rounded primary ribs, two of which are ventral, two dorsal and two pairs lateral. Secondary ribs present, intercostal spaces convex to straight; the entire surface usually strongly cancellate. Apex with the ventral wall wider and a ventral lobe, often with a regularly spaced series of holes creating the lobe by reabsorption. Preapical callus thin. Section starlike to polygonal, oral aperture thin.
Radula rachidian high, subtriangular, similar to that of *Pertusiconcha*; lateral well armed, with two primary cusps and denticles; marginal slightly curved.

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Spadentalina tubiformis (Boissevain, 1906)

Figs 111 i-j, 112, 115 e, 172 a-b

Dentalium tubiforme Boissevain, 1906: 19, pl. 6, fig. 5.

Other references:

Spadentalina tubiformis — HABE, 1964a: 11, pl. 4, figs 9-12; 1977: 333. — HABE & KOSUGE, 1964: 5. — CHISTIKOV, 1982a: 677, pl. 3, figs 8-14, pl. 5, fig. 3. — HIGO & GOTO, 1993: 686.

Source : MNHN, Paris

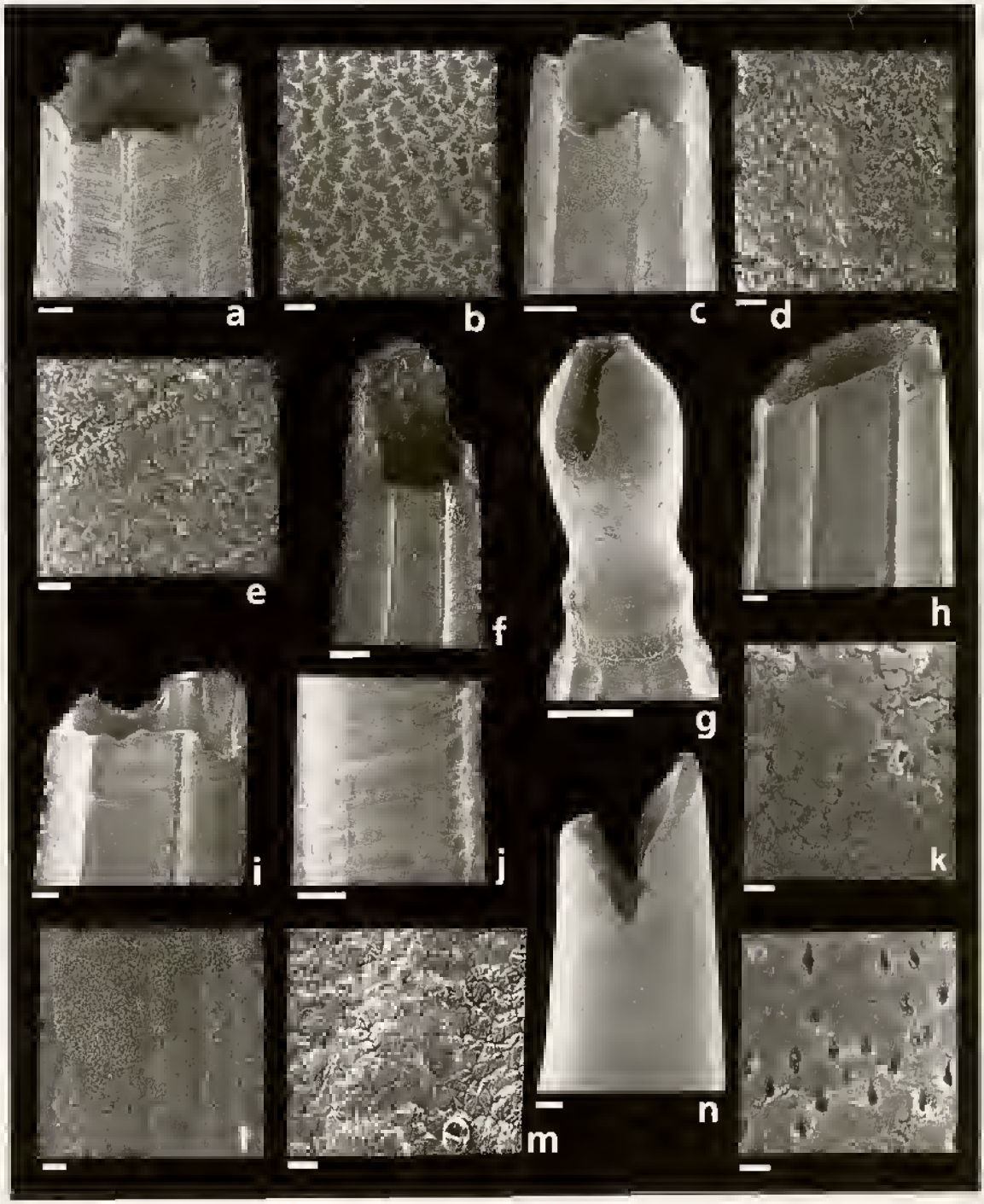


FIG. 111. — **a**, *Entalinopsis stellata*, paratype, apex of a nine-ribbed specimen. — **b**, same specimen, detail of surface in intercostal space. — **c**, *Entalinopsis micra*, paratype, apex. — **d**, same specimen, detail of surface in intercostal space. — **e**, *Spadentalina ingrata*, paratype, detail of surface in intercostal space. — **f**, same specimen, apex. — **g**, *Spadentalina ingrata*, specimen with the embryonic shell. — **h**, *Costentalina tuscarorae*, apex. — **i**, *Spadentalina tubiformis*, apex. — **j**, same specimen, detail of surface. — **k**, *Costentalina tuscarorae*, detail of surface in intercostal space. — **l**, *Striopulsellum minimum*, detail of surface. — **m**, *Solenoxiphus striatulus*, detail of surface of a rib and intercostal spaces. — **n**, *Dischides minutus*, apex. — **o**, same specimen, detail of surface. Scale lines: 100 µm (a, c, f, g, h, i, n), 10 µm (l), 2 µm (b, d, e, j, k, m, o).

Source : MNHN, Paris

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.013, paralectotypes ZMA 3.06.012.

TYPE LOCALITY. — Indonesia, *"Siboga"*, stn 212, 05°56′ S, 120°19′ E, 462 m.

MATERIAL EXAMINED. — The type material.
Indonesia. CORINDON: stn B 210, 00°13′ S, 117°53′ E, 338 m, 2 dd. — Stn B 207, 00°15′ S, 117°52′ E, 150 m, 3 dd. — Stn B 248, 00°54′ S, 119°29′ E, 170 m, 14 dd.
"Snellius" II: stn 4.112, 08°19′ S, 118°16′ E, 365 m, 6 dd. — Stn 4.113, 08°18′ S, 118°16′ E (no depth data), 2 dd. — Stn 4.135, 06°29′ S, 121°09′ E, 495 m, 1 lv (RMNH).
Philippines. MUSORSTOM 2: stn CP 82, 13°46′ N, 120°28′ E, 550 m, 3 dd. — Stn DR 83, 13°55′ N, 120°30′ E, 318-320 m, 3 lv.
MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd. — Stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 3 dd. — Stn CP 122, 12°20′ N, 121°42′ E, 673-675 m, 2 dd. — Stn CP 123, 12°11′ N, 121°45′ E, 700-702 m, 1 dd.

FIG. 112. — Distribution of *Spadentalina tubiformis*.

DISTRIBUTION. — Indonesia and Japan, now recorded from the Philippines, alive in 318-495 m, shells down to 702 m (present paper).

Spadentalina ingrata sp. nov.

Figs 111 e-g, 113, 115 f

TYPE MATERIAL. — Holotype MNHN. Paratypes: 12 MNHN, 1 AMS C201731, 1 NMNZ M268951, 1 USNM.

TYPE LOCALITY. — Loyalty Islands, MUSORSTOM 6, stn DW 444, 20°54′ S, 167°18′ E, 300 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. CHALCAL 1: stn DC 38, 20°00′ S, 158°46′ E, 250 m, 2 dd.
MUSORSTOM 5: stn DW 280, 24°10′ S, 159°36′ E, 270 m, 1 dd (paratype USNM). — Stn DW 282, 24°12′ S, 159°32′ E, 226-230 m, 3 dd (paratypes: 2 MNHN, 1 AMS). — Stn DW 285, 24°09′ S, 159°34′ E,

Source : MNHN, Paris

245-255 m, 3 dd. — Stn DW 334, 20°06′ S, 158°48′ E, 315-320 m, 1 dd (paratype). — Stn DW 335, 20°03′ S, 158°45′ E, 315 m, 1 dd. — Stn DW 344, 19°39′ S, 158°34′ E, 310 m, 1 dd (paratype).
New Caledonia. *"Vauban"* 1978-79: stn 33, 22°33′ S, 166°25′ E, 290-335 m, 3 dd. — Stn 34, 22°32′ S, 166°26′ E, 350-420 m, 1 dd (paratype). — Stn 35, 22°32′ S, 166°26′ E, 250-375 m, 1 dd. — Stn 37, 22°32′ S, 166°26′ E, 175-250 m, 2 dd. — Stn 40, 22°30′ S, 166°24′ E, 250-350 m, 15 lv, 166 dd (paratypes: 3 MNHN, 1 NMNZ).
BIOCAL: stn DW 43, 22°46′ S, 167°15′ E, 400 m, 1 dd. — Stn DW 77, 22°15′ S, 167°15′ E, 440 m, 1 lv. — Stn DW 104, 21°31′ S, 166°21′ E, 375-450 m, 4 dd.
BIOGEOCAL: stn KG 252, 21°31′ S, 166°21′ E, 330 m, 1 dd. — Stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 17 dd (1 paratype).
Passe de Boulari, B. Richer/ORSTOM coll., 400 m, 5 lv.
Loyalty Islands. MUSORSTOM 6: stn DW 406, 20°41′ S, 167°07′ E, 373 m, 1 dd. — Stn DW 411, 20°40′ S, 167°03′ E, 424 m, 1 lv. — Stn DW 444, 20°54′ S, 167°18′ E, 300 m, 1 lv (holotype). — Stn DW 446, 20°54′ S, 167°19′ E, 360 m, 3 dd (paratypes). — Stn DW 449, 20°54′ S, 167°18′ E, 300 m, 1 dd. — Stn DW 485, 21°23′ S, 167°59′ E, 350 m, 1 dd.
Indonesia. *"Snellius"* II: stn 4.031, 05°54′ S, 123°58′ E, 390 m, 1 dd.
Philippines. MUSORSTOM 1: stn CP 62, 14°00′ N, 120°16′ E, 179-194 m, 1 dd.
MUSORSTOM 2: stn CP 20, 14°00′ N, 120°18′ E, 185-192 m, 1 lv, 1 dd. — Stn CP 72, 14°00′ N, 120°18′ E, 182-197 m, 1 lv.
MUSORSTOM 3: stn CP 102, 14°01′ N, 120°18′ E, 192 m, 1 lv, 6 dd. — Stn DR 126, 11°49′ N, 121°22′ E, 266 m, 4 dd.

FIG. 113. — Distribution of *Spadentalina ingrata*.

DISTRIBUTION. — The Philippines, Indonesia, New Caledonia, alive from 182 to 440 m.

DESCRIPTION. — *Shell* to 37 mm long, slender, solid. Young specimens regularly curved, adults vary from almost straight to regularly curved or curved only at the posterior end. Sculpture of 8 primary ribs, prominent throughout. Intercostal spaces with 6 to 7 riblets crossed by transversal lines, giving a slightly cancellate appearance. Apex with long lobe-like structure on the ventral side in fresh specimens, showing only the base when broken. Mouth straight, octogonal in section, slightly compressed laterally.

Measurements: holotype L 24.5, W 2.65, w 0.82, arc 2.5; paratypes L 36.4, W 2.2, w 1, arc 0.5; L 26.2, W 1.85, w 0.65, arc 1; L 30.6, W 2, w 1.5, arc 2.5; L 30.5, W 2.2, w 1.2, arc 2; L 25.4; W 2.3, w 0.8, arc 1.5; L 27.6, W 2.5, w 0.85, arc 1.2; L 34.7, W 2.6, w 1.1, arc 1; L 19.2, W 1.2, w 0.4, arc 0.5. W/w ratio 1.3-3.2.

Source : MNHN, Paris

REMARKS. — This species is variable in curvature, but constant in sculpture. It differs from *Spadentalina tubiformis* from which it differs in the less prominent cancellate sculpture. The dorsal lobe is often regularly perforated on both sides (Fig. 115f) in fresh specimens. This character is also noted in *Pertusiconcha* and may be caused by the reabsorption process that forms the apical structure. This species may have been confused with *Entalinopsis habutae* but the later has 6 ribbs and a better defined sculpture.

ETYMOLOGY. — From the Latin *ingrata*, indicating the difficulties noted in defining the species.

Genus *PERTUSICONCHA* Chistikov, 1982

Type species (OD): *Dentalium callithrix* Dall, 1889. Recent, Yucatan strait, 640 fms [1170 m].

DIAGNOSIS. — *Shell* medium to large, slightly curved, solid, opaque or polished, chalky white. Longitudinal sculpture of 8 primary ribs and convex intercostal spaces. Apex truncate, irregular by presence of regularly or irregularly spaced circular holes. Preapical callus prominent, lumen circular. Section oval, laterally compressed.
Radula rachidian high, subtriangular with rounded anterior margin, lateral half folded in, especially at base; lateral head with one sharp pointed primary cusp and several subequal denticles; marginal slightly curved (Fig. 115 g).

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Pertusiconcha tridentata Chistikov, 1982

Figs 114, 115 h

Pertusiconcha tridentata Chistikov, 1982a: 678, pl. 4, figs 2-13.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV).

TYPE LOCALITY. — *"Dimitri Mendeleyev"*, stn 1244T, Tasman Sea, 31°43′ S, 159°00′ E, 1640 m.

FIG. 114. — Distribution of *Pertusiconcha tridentata*.

Source : MNHN, Paris

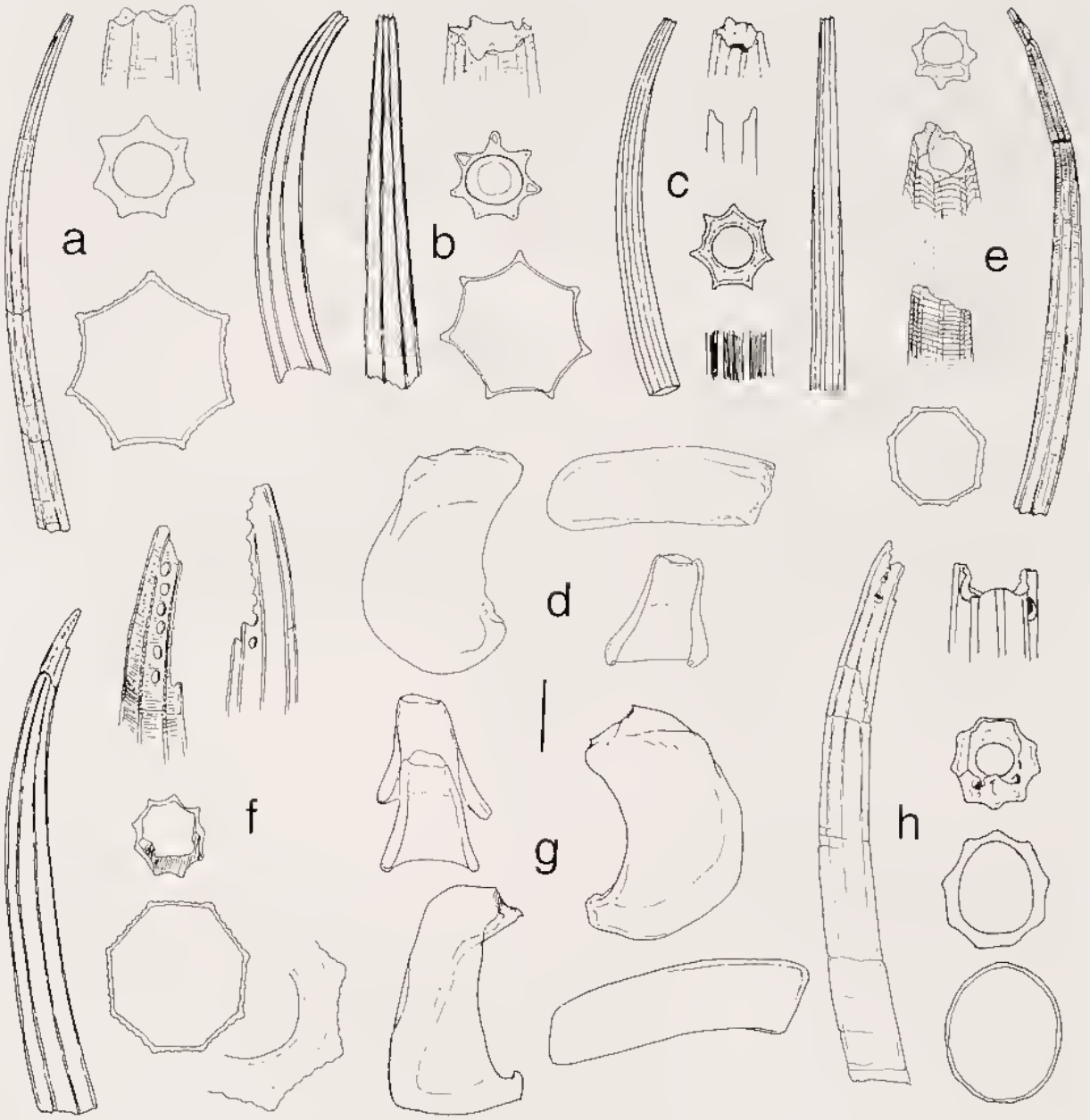


FIG. 115. — **a**, *Entalinopsis intercostata*, shell (55 mm), apex, apical and oral sections, MUSORSTOM 2, stn CP 24. — **b**, *Entalinopsis stellata* sp. nov., holotype, shell (22.7 mm), apex, apical and oral sections. — **c**, *Entalinopsis micra* sp. nov., holotype, shell (6.8 mm), apex and sagital section of apex, apical section, detail of sculpture. — **d**, *Entalinopsis* type radula (*E. intercostata*). — **e**, *Spadentalina tubiformis*, shell (37 mm), apex, apical and oral sections, MUSORSTOM 2; stn CP 82. — **f**, *Spadentalina ingrata* sp. nov., holotype, shell (24.5 mm), apex, apical and oral sections, section near the apex. — **g**, *Pertusiconcha* type radula (*P. callithrix*, Western Atlantic Ocean, Puerto Rico Trench). — **h**, *Pertusiconcha tridentata*, shell (29 mm), apex, apical, medial and oral section. BIOCAL: stn DS 04.

MATERIAL EXAMINED. — **New Zealand**. *"Galathea"*: stn 665, 36°38′ S, 178°21′ E, 2470 m, 1 dd. **New Caledonia**. BIOCAL: stn DS 04, 21°16′ S, 166°40′ E, 2340 m, 1 dd. — Stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 dd. — Stn KG 71, 22°10′ S, 167°33′ E, 2099 m, 1 dd. — Stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m, 1 lv, 1 dd. — Stn CP 75, 22°19′ S, 167°23′ E, 825-860 m, 1 lv. — Stn DW 79, 20°40′ S, 166°52′ E, 1320-1380 m, 3 dd. — Stn KG 86, 21°01′ S, 166°58′ E, 1860 m,

Source : MNHN, Paris

1 dd. — Stn KG 89, 21°03′ S, 166°56′ E, 2070 m, 1 lv. — Stn DS 98, 21°24′ S, 166°30′ E, 2365-2470 m, 2 dd. — Stn KG 102, 21°28′ S, 166°26′ E, 1810 m, 1 lv.
BIOGEOCAL: stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 1 dd. — Stn KG 262, 21°02′ S, 167°02′ E, 1380 m, 1 lv. — Stn CP 266, 21°05′ S, 166°57′ E, 1990-2100 m, 2 dd. — Stn CP 273, 21°02′ S, 166°57′ E, 1920-2040 m, 1 dd. — Stn CP 321, 21°12′ S, 167°00′ E, 2190-2205 m, 1 dd.
Philippines. ESTASE 2: stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DR 40, 12°56′ S, 45°18′ E, 1300-1480 m, 1 lv.

DISTRIBUTION. — Tasman Sea, now extended to New Zealand, New Caledonia, the Philippines and Madagascar. Recorded alive from 825 to 2070 m, shells down to 2470 m.

Subfamily BATHOXIPHINAE Chistikov, 1983

Genus *Bathoxiphus* Pilsbry & Sharp, 1897

Type species (SD by BOISSEVAIN, 1906): *Dentalium ensiculum* Jeffreys, 1877. Recent, North Atlantic Ocean.

DIAGNOSIS. — *Shell* small to medium in size, well arched, solid, polished, white. Almost unsculptured, angled at dorsal and lateral sides. Apex truncate, lumen circular, located submedially due to dorsal wall width in apical area. Section oval, strongly laterally compressed.
Radula rachidian high, anterior margin simple, rounded with latter half folded inward; lateral with two pointed primary cusps and 5 to 6 subequal secondary cusps; marginal slightly curved.

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Bathoxiphus soyomaruae Okutani, 1964
Figs 116, 121 a-b

Bathoxiphus soyomaruae Okutani, 1964: 77, fig. 4.

Other references:

Bathoxiphus soyomaruae — HABE, 1964a: 34, pl. 5, figs 61-62; 1977: 337, pl. 70, figs 17-18. — HABE & KOSUGE, 1964: 6. — OKUTANI, 1974: 26, 28, 34; 1975: 77 (as synonym of *Dentalium colmani*). — CHISTIKOV, 1983: 183, pl. 3, figs 6-22, pl. 4, figs 6-9. — HIGO & GOTO, 1993: 688.

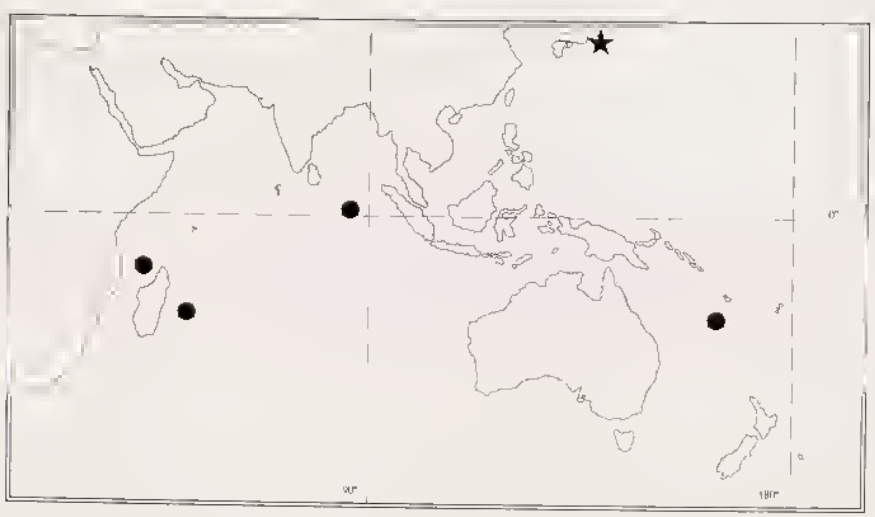


FIG. 116. — Distribution of *Bathoxiphus soyomaruae*.

Source : MNHN, Paris

TYPE MATERIAL. — NSMT, not checked.

TYPE LOCALITY. — Japan, off Aogashima Island, 3150-3350 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 322, 21°19′ S, 158°00′ E, 975 m, 1 lv, 1 dd.
New Caledonia. BIOGEOCAL: stn KG 233, 21°31′ S, 166°25′ E, 1040 m, 2 lv, 2 dd.
West Indian Ocean. BENTHEDI: stn CH 87, 11°44′ S, 47°35′ E, 3716 m, 1 dd. — Stn CH 90, 11°44′ S, 47°30′ E, 3700 m, 1 lv.
MD 32 Réunion: stn DS 151, 21°51′ S, 56°03′ E, 3240-3300 m, 1 lv. — Stn DS 149, 20°26′ S, 55°40′ E, 3500-3510 m, 1 dd.
East Indian Ocean. SAFARI 2: stn CP 10, 01°43′ N, 87°08′ E, 4350 m, 1 lv.

DISTRIBUTION. — Japan, now extended to New Caledonia and the Indian Ocean, living from 975 m (present paper) to 5750 m (CHISTIKOV, 1983).

Bathoxiphus inexpectatus sp. nov.

Figs 117, 121 c

TYPE MATERIAL. — Holotype MNHN. Paratypes: 11 MNHN, 1 AMS C201732, 1 NMNZ M268952, 1 USNM.

TYPE LOCALITY. — New Caledonia, N Norfolk Ridge, BIOCAL, stn DW 46, 22°53′ S, 167°17′ E, 570-610 m.

FIG. 117. — Distribution of *Bathoxiphus inexpectatus*.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM: 5 stn DW 362, 19°53′ S, 158°40′ E, 410 m, 1 lv.
New Caledonia. BIOCAL: stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 6 lv, 4 dd. — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 20 lv (holotype and paratypes: 10 MNHN, 1 AMS, 1 NMNZ, 1 USNM), 17 dd. — Stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 1 dd.
SMIB 3: stn DW 22, 23°03′ S, 167°19′ E, 503 m, 1 dd.

Source : MNHN, Paris

LAGON: stn 830, 20°49′ S, 165°19′ E, 105-110 m, 1 dd (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 459, 21°01′ S, 167°31′ E, 425 m, 2 lv, 11 dd.

DISTRIBUTION. — New Caledonia, live records between 410 and 570 m.

DESCRIPTION. — *Shell* to 13 mm long, lacking sculpture, polished, arched, translucent white. Section slightly compressed laterally throughout. Apex strong with two lateral flat V-shaped notches, preapical callus prominent, lumen circular, mouth straight.
Measurements: holotype L 11.9, W 1.2-1.1, w 0.5-0.45, arc 1.6. W/w ratio 2.4.

ETYMOLOGY. — From the Latin, meaning unexpected.

Genus *RHOMBOXIPHUS* Chistikov, 1983

Type species (OD): *Dentalium tricarinatum* Boissevain, 1906.

DIAGNOSIS. — *Shell* small to medium, well arched, solid, polished, white, translucent. Sculpture of 4 flat primary ribs, located ventrally, dorsally and laterally; secondary ribs may be present. Apex truncate, lumen circular located submedially due to the dorsal side width at apical area. Section rhomboidal, strongly laterally compressed.
Radula similar to that of *Bathoxiphus*.

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Rhomboxiphus tricarinatus (Boissevain, 1906)

Figs 118, 121 d, f

Dentalium tricarinatum Boissevain, 1906: 48, pl. 6, figs 40-41.

Synonym:
Dentalium (Compressidens) capense Tomlin, 1931: 340 (**Syn. nov.**).

Other references:
Dentalium (Bathoxiphus) tricarinatus — PLATE, 1908a: 354.
Bathoxiphus tricarinatus — HABE, 1964a: 33, pl. 5, figs 69-70; 1977: 337, pl. 70, figs 15-16. — HABE & KOSUGE, 1964: 6. — HIGO & GOTO, 1993: 688.
Bathoxiphus tricarinatum — OKUTANI, 1964: 76, pl. 6, fig. 10.
Dentalium capense — BARNARD, 1963a: 446; 1963b: 349, fig. 30d; 1974: 742.

TYPE MATERIAL. — *D. tricarinatum*: lectotype (here designated) ZMA 3.06.060, paralectotypes ZMA 3.06.056-059. — *D. capense*: holotype SAM.

TYPE LOCALITY. — *D. tricarinatus*: Indonesia, Ceram Sea, "*Siboga*", stn 178, 02°40′ S, 128°37′ E, 835 m. — *D. capense*: South Africa, "Cape Point, N 86° E, 43 miles, 900 fms" [1645 m].

MATERIAL EXAMINED. — The type material.
Tasman Sea. "*Galathea*": stn 574, 39°45′ S, 159°39′ E, 4680-4730 m, 1 dd.
New Caledonia. BIOCAL: stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 9 dd.
BIOGEOCAL: stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 1 dd. — Stn DW 313, 20°59′ S, 166°59′ E, 1600-1640 m, 1 dd.
CALSUB: dive 13, 21°26′ S, 166°23′ E, 1600 m, 1 dd.
Indonesia. CORINDON: stn B 244, 00°56′ N, 119°22′ E, 970 m, 4 dd.
"*Snellius*" II: stn 4.135, 06°29′ S, 121°09′ E, 495 m, 1 dd.

Source : MNHN, Paris

Philippines. ESTASE 2: stn DW 1, 14°05′ N, 120°01′ E, 2200 m, 1 dd. — Stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 13 lv, 10 dd.
MUSORSTOM 2: stn CP 55, 13°54′ N, 119°58′ E, 865 m, 1 dd.
MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DS 02, 12°35′ S, 47°40′ E, 1750 m, 3 lv. — Stn DS 03, 12°36′ S, 47°38′ E, 1100-1150 m, 1 dd. — Stn DR 11, 12°16′ S, 46°42′ E, 2300-2450 m, 1 dd. — Stn DR 27, 12°38′ S, 47°12′ E, 675 m, 1 dd. — Stn DR 28, 12°42′ S, 45°20′ E, 705 m, 1 dd. — Stn DS 64, 12°41′ S, 44°57′ E, 770-860 m, 1 dd.
MD 32 Réunion: stn DC 64, 21°12′ S, 55°04′ E, 1150-1180 m, 3 dd. — Stn DR 67, 21°13′ S, 55°01′ E, 1390-1425 m, 1 dd. — Stn DS 78, 21°13′ S, 55°04′ E, 1175-1200 m, 2 lv, 2 dd. — Stn DS 100, 21°27′ S, 55°47′ E, 4180-4220 m, 1 lv. — Stn DR 104, 20°49′ S, 55°01′ E, 1875-1920 m, 2 dd. — Stn DS 106, 20°48′ S, 55°05′ E, 1710-1730 m, 1 dd. — Stn DS 109, 20°52′ S, 55°06′ E, 1050-1240 m, 7 lv, 6 dd.
"Galathea": stn 234, 05°25′ S, 47°09′ E, 4830 m, 1 lv.
South Africa. *"Meiring Naudé"*: stn 94, 28°16′ S, 32°29′ E, 670 m, 1 lv, 1 dd.

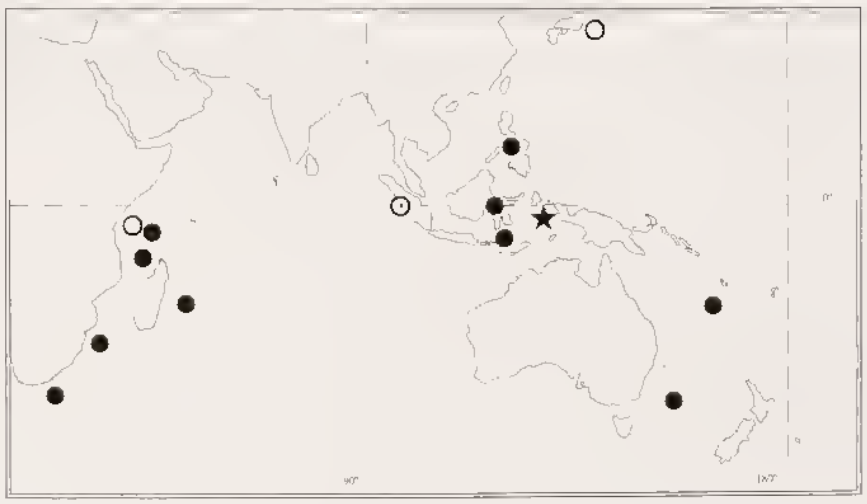


FIG. 118. — Distribution of *Rhomboxiphus tricarinatus*.

DISTRIBUTION. — From Japan to the East coast of Africa, 639-1900 m (HABE & KOSUGE, 1964), now recorded from the Philippines and the SW Pacific. Live records from 495 to 4830 m.

Rhomboxiphus colmani (Palmer, 1974)

Figs 119, 121 e

Dentalium (Bathoxiphus) applanatum Colman, 1958: 145, fig. 12 (*non D. applanatum* Torley, 1908).
Dentalium (Bathoxiphus) colmani Palmer, 1974b: 124, *nom. nov. pro D. applanatum* Colman.

Other references:

Bathoxiphus colanni (*sic*) — OKUTANI, 1975: 77, pl. 3, figs 6-7 (erroneous subsequent spelling).
Rhomboxiphus colmani — CHISTIKOV, 1983: 183.

TYPE MATERIAL. — Holotype and 3 paratypes dd AMS 26652.

TYPE LOCALITY. — Australia, New South Wales, 35 miles E of Sydney, 1463 m.

Source : MNHN, Paris

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DC 379, 19°53′ S, 158°40′ E, 370-400 m, 1 lv.
New Caledonia. BIOGEOCAL: stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 2 lv, 4 dd.

FIG. 119. — Distribution of *Rhomboxiphus colmani*.

DISTRIBUTION. — E Australia now extended to New Caledonia, alive in 370-790 m, shells down to 1463 m.

REMARKS. — CHISTIKOV (1983) synonymized this species with *Bathoxiphus soyomaruae*, but study of type specimens confirms the validity of *Rhomboxiphus colmani*. It is similar to *Rhomboxiphus tricarinatus*, but less sculptured.

Genus *SOLENOXIPHUS* Chistikov, 1983

Type species (by monotypy): *S. striatulus* Chistikov, 1983.

DIAGNOSIS. — *Shell* medium sized, slightly curved, solid, translucent when fresh, white opaque to polished when dead. Longitudinally striated throughout. Apex oblique, the dorsal angle higher than the ventral side, preapical callus wide, lumen circular. Section strongly laterally compressed, dorsal and ventral sides rounded, laterals straight parallel or slightly concave.
Radula rachidian with lateral sides almost parallel, anterior margin with central lobe; laterals with two main cusps and four denticles between, with a third cusp located at the base of the external cusp; marginals slightly sinusoidal.

DISTRIBUTION. — Recent, Pacific Ocean, bathyal-abyssal.

Solenoxiphus striatulus Chistikov, 1983
Figs 111 m, 120, 121 g-h, 172 g

Solenoxiphus striatulus Chistikov, 1983: 187-188, pl. 3, figs 2-13, pl. 5, figs 10-11.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV).

TYPE LOCALITY. — *"Vitiaz"*, stn 5944-2, North Fiji basin, 14°21′ S, 179°38′ E, 2380 m.

Source : MNHN, Paris

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn KG 03, 21°15′ S, 166°39′ E, 2340 m, 1 lv, 1 dd. — Stn DS 04, 21°16′ S, 166°40′ E, 2340 m, 3 lv, 6 dd. — Stn CP 05, 21°16′ S, 166°44′ E, 2340 m, 1 lv, 3 dd. — Stn DS 14, 20°19′ S, 167°18′ E, 3680-3700 m, 2 lv. — Stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 lv, 3 dd. — Stn KG 71, 22°10′ S, 167°33′ E, 2099 m, 2 dd. — Stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m, 10 lv. — Stn KG 85, 20°59′ S, 167°00′ E, 1639 m, 1 lv. — Stn KG 89, 21°03′ S, 166°56′ E, 2070 m, 2 lv, 7 dd. — Stn KG 90, 21°08′ S, 166°48′ E, 2236 m, 4 dd. — Stn DS 98, 21°24′ S, 166°30′ E, 2365-2470 m, 7 lv, 1 dd. — Stn KG 101, 21°27′ S, 166°24′ E, 1790 m, 1 dd. — Stn KG 102, 21°28′ S, 166°26′ E, 1810 m, 1 dd.
BIOGEOCAL: stn KG 207, 22°38′ S, 166°29′ E, 1350 m, 1 dd. — Stn KG 240, 21°29′ S, 166°27′ E, 1520 m, 1 lv. — Stn CP 243, 21°27′ S, 166°26′ E, 1820 m, 1 dd. — Stn KG 248, 21°15′ S, 166°29′ E, 2340 m, 1 lv, 2 dd. — Stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 1 lv, 1 dd. — Stn KG 261, 21°02′ S, 167°02′ E, 1508 m, 1 lv, 1 dd. — Stn KG 267, 21°02′ S, 166°59′ E, 1935 m, 2 dd. — Stn KG 268, 21°03′ S, 166°57′ E, 1990 m, 1 dd. — Stn KG 269, 21°02′ S, 166°58′ E, 1810 m, 2 dd. — Stn KG 275, 21°06′ S, 166°53′ E, 1959 m, 2 lv, 1 dd. — Stn KG 277, 21°17′ S, 166°56′ E, 2240 m, 1 lv. — Stn KG 287, 20°43′ S, 166°53′ E, 1560 m, 1 lv. — Stn CP 317, 20°48′ S, 166°53′ E, 1620-1630 m, 1 dd.
CALSUB: dive 13, 21°26′ S, 166°23′ E, 1600 m, 1 lv.

FIG. 120. — Distribution of *Solenoxiphus striatulus*.

DISTRIBUTION. — North Fiji Basin, now extended to New Caledonia, alive in 1500-3700 m.

Suborder GADILIMORPHA Steiner, 1992

Family PULSELLIDAE Scarabino *in* Boss, 1982

Genus *PULSELLUM* Stoliczka, 1868

Type species (SD by COSSMANN, 1888): *Siphonodentalium lofotense* Sars, 1865. Recent, Norwegian Sea, bathyal.

DIAGNOSIS. — *Shell* small, slightly to markedly curved, fragile, translucent to white in dead shells. Sculptured by growth lines, occasionally conspicuous. Apex simple, preapical callus thin, lumen circular. Section circular.

Source : MNHN, Paris

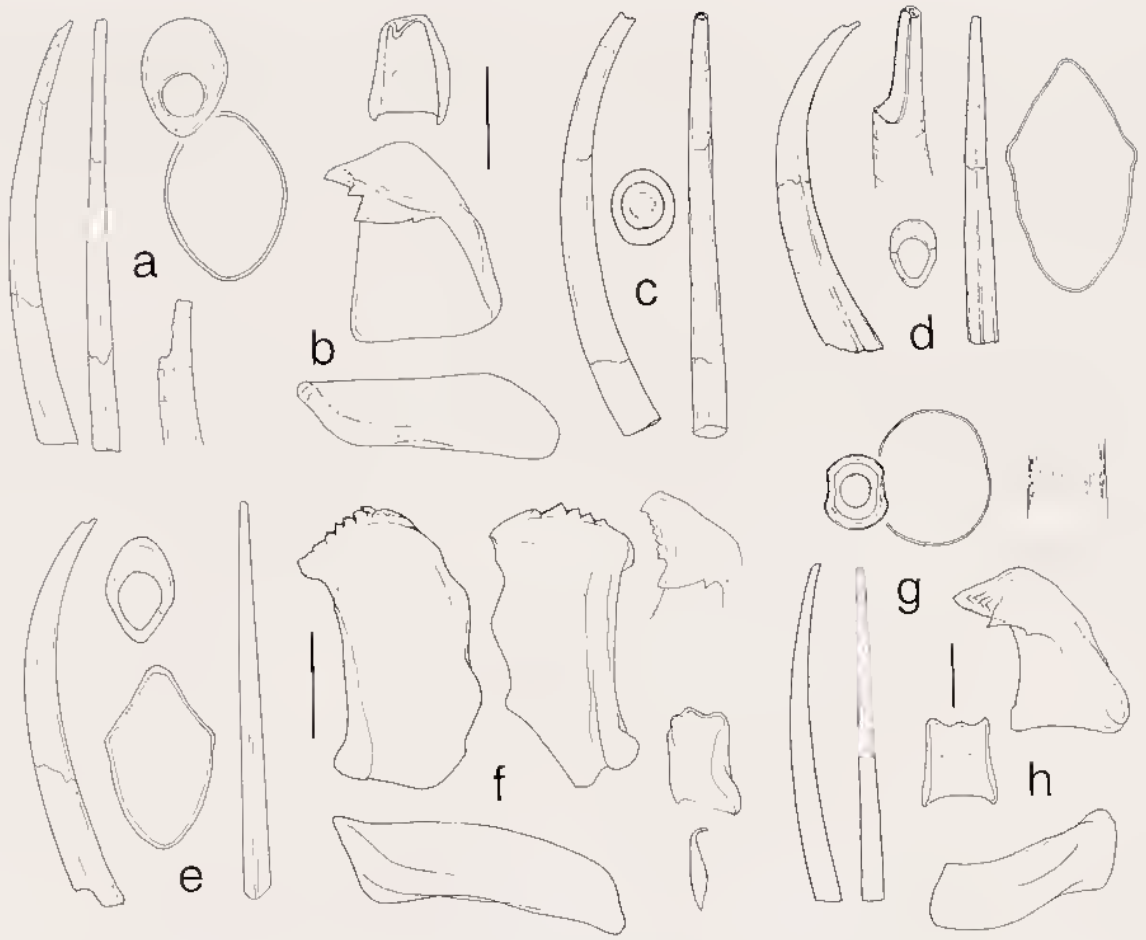


FIG. 121. — **a**, *Bathoxiphus soyomaruae*, shell (22 mm), apex, apical and oral sections, BIOGEOCAL: stn KG 233. — **b**, *Bathoxiphus* type radula (*B. soyomaruae*). — **c**, *Bathoxiphus inexpectatus* sp. nov., holotype, shell (11.9 mm), apical section. — **d**, *Rhomboxiphus tricarinatus*, shell (19 mm), lateral and dorsal views, apex, apical and oral sections, MD 32 Réunion: stn DS 109. — **e**, *Rhomboxiphus colmani*, shell (16 mm), lateral and dorsal views, apical and oral sections, BIOGEOCAL: stn CP 232. — **f**, *Rhomboxiphus* type radula (*R. tricarinatus*). — **g**, *Solenoxiphus striatulus*, shell (16 mm), apical and oral sections, detail of the sculpture, BIOCAL: stn KG 85. — **h**, *Solenoxiphus* type radula (*S. striatulus*).

Radula rachidian polygonal, sides almost parallel, generally with a single cusp on anterior margin; laterals high, with two primary cusps on inner side, one on outer side, 2 to 3 denticles between cusps; marginals slightly sigmoidal.

DISTRIBUTION. — Paleocene-Recent, worldwide, shelf-abyssal.

Pulsellum fragile sp. nov.

Figs 122, 125 a

TYPE MATERIAL. — Holotype lv, MNHN. Paratypes lv: 14 MNHN, 1 NMP.

TYPE LOCALITY. — West Indian Ocean, MD 32 Réunion, stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m.

Source : MNHN, Paris

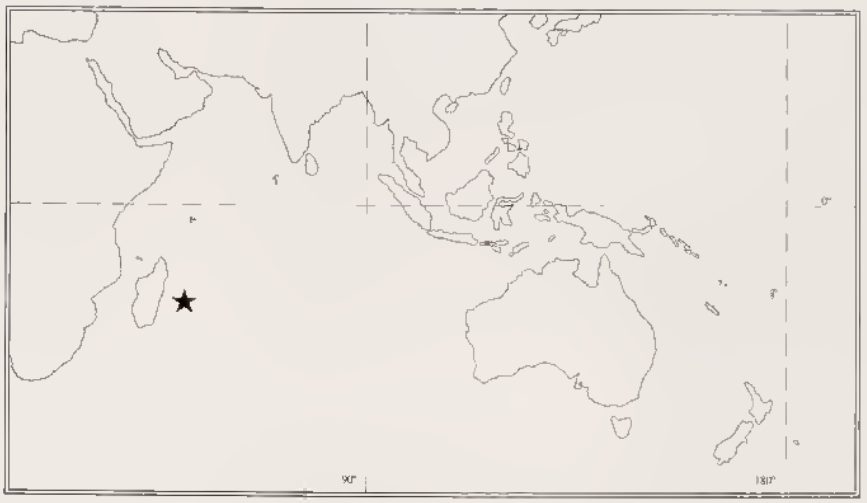


FIG. 122. — Distribution of *Pulsellum fragile*.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only know from the type locality.

DESCRIPTION. — *Shell* 1o 3 mm long, fine, delicate, regularly curved, translucent white, opaque. Apical area with fine encircled wrinkles. Section circular, apex simple, mouth simple. Subapical callus weak.

Measurements: holotype L 3, W 0.5, w 0.2, arc 0.3; paratype L 3, W 0.5, w 0.2, arc 0.3; L 3, W 0.5, w 0.2, arc 0.3; L 2.3, W 0.4, w 0.1, arc 0.2; L 2, W 0.4, w 0.1, arc 0.2. W/w ratio 2.5-4.

REMARKS. — *Pulsellum fragile* differs from *P. thomassini* in general shape, by its smaller W/w ratio and better defined transversal sculpture.

ETYMOLOGY. — From the Latin *fragilis*, fragile.

Pulsellum thomassini sp. nov.

Figs 123, 125 b

TYPE MATERIAL. — Holotype and 6 paratypes MNHN.

TYPE LOCALITY. — West Indian Ocean, BENTHEDI, stn DR 11, 12°16′ S, 46°42′ E, 2300-2450 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn KG 86, 21°01′ S, 166°58′ E, 1860 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DR 11, 12°16′ S, 46°42′ E, 2300-2450 m, 1 lv (holotype). — Stn 88, 11°46′ S, 47°34′ E, 3700 m, 2 lv (paratypes).
MD 32 Réunion: stn DS 106, 20°28′ S, 55°05′ E, 1710-1730 m, 2 lv (paratypes). — Stn DS 151, 20°51′ S, 56°03′ E, 3240-3300, 2 lv (paratypes).

DISTRIBUTION. — SW Indian Ocean and New Caledonia, live records from 1730 to 3716 m.

DESCRIPTION. — *Shell* up 1o 6 mm long, fine, delicate, translucent-white, opaque, regularly curved. Circular in section, apex simple, mouth simple. Subapical callus weak.

Measurements: holotype L 6, W 0.9, w 0.6, arc 0.2; paratypes L 5.6, W 0.8, w 0.5, arc 0.2; L 6, W 0.9, w 0.5, arc 0.2; L 6, W 0.8, w 0.6, arc 0.2. W/w ratio 1.3-1.8.

Source : MNHN, Paris

FIG. 123. — Distribution of *Pulsellum thomassini*.

ETYMOLOGY. — Named for Dr Bernard THOMASSIN, Centre Océanologique de Marseille, cruise leader of the BENTHEDI Expedition (1977).

Other Indo-Pacific species of *Pulsellum* cited in the literature

Pulsellum eboracense (Watson, 1879): 523. *"Challenger"*, Torres Strait, Cape York, NE Australia, 9-20 m, 4 syntypes dd BMNH 1887.2.9.69.
Pulsellum hige Habe, 1963: 273, textfigs 47-48. Zushi, Kanagawa, Honshu, Japan, 350 m. NSMT.
Pulsellum kurogenge Habe & Kosuge, 1964: 9. Off Choshi, Chiba Prefecture, Japan, 350 m. NSMT.

Genus *ANNULIPULSELLUM* Scarabino, 1986

Figs 125 d-e

Type species (by monotypy): *Annulipulsellum euzkadii* Scarabino, 1986. Recent, Atlantic Ocean, 12°34' N, 59°09' W, *"Knorr"*, cruise 25, stn 307, 3835-3862 m.

DIAGNOSIS. — *Shell* small to medium sized, fine, regularly curved, translucent white. Sculpture of angulated rings over the entire surface. Apex oblique, preapical callus prominent, cross section circular. Two large central pedal retractor muscles originate directly from dorsoventral muscles and cross the intestinal sinus; pedal base and central portion enter at terminal disk. Center of disk covered by a mucoid epithelium (STEINER 1992b).
Radula rachidian small, high with central denticle at anterior margin; laterals high with two very sharp primary cusps; marginals sinusoidal.

DISTRIBUTION. — Atlantic Ocean, bathyal-abyssal.

The genus *Annulipulsellum* has not been recorded in the Indo-Pacific.

Source : MNHN, Paris

Genus *STRIOPULSELLUM* gen. nov.

Striopulsellum Scarabino, 1979 (published in a thesis, not available).
Striopulsellum Scarabino *in* Boss 1982: 1166 *nom. nud.* (no diagnosis, no species included).
Type species: *Siphonodentalium minimum* Plate, 1908.

DIAGNOSIS. — *Shell* small to medium sized, sculpture of fine, numerous, smooth longitudinal riblets, with secondary riblets near apex; primary riblets throughout. Apex simple, straight or oblique, preapical callus wide.
Radula rachidian polygonal, anterior margin with single cusp; lateral with 1 to 5 denticles between cusps; marginals slightly curved.

DISTRIBUTION. — Pacific and Atlantic Oceans, Southern Ocean, Recent. Bathyal-hadal.

REMARKS. — This genus contains 7 deep-sea species (4 undescribed), mostly known from Atlantic Ocean basins. The named species are *S. striatinum*, *S. minimum* and *S. galatheae*. With a live record from the Sunda Trench in 6900-7000 m, *S. galatheae* is the deepest known scaphopod taken alive.

Striopulsellum minimum (Plate, 1908)

Figs 111 l, 124, 125 f-g

Siphonodentalium minimum Plate, 1908b: 4, fig. 5.

TYPE MATERIAL. — Lectotype, designated by KILIAS (1995), ZMB 59728a.

TYPE LOCALITY. — Antarctic, *"Gauss"* Winterstation (approximately 66°02' S, 89°38' W), 3423 m.

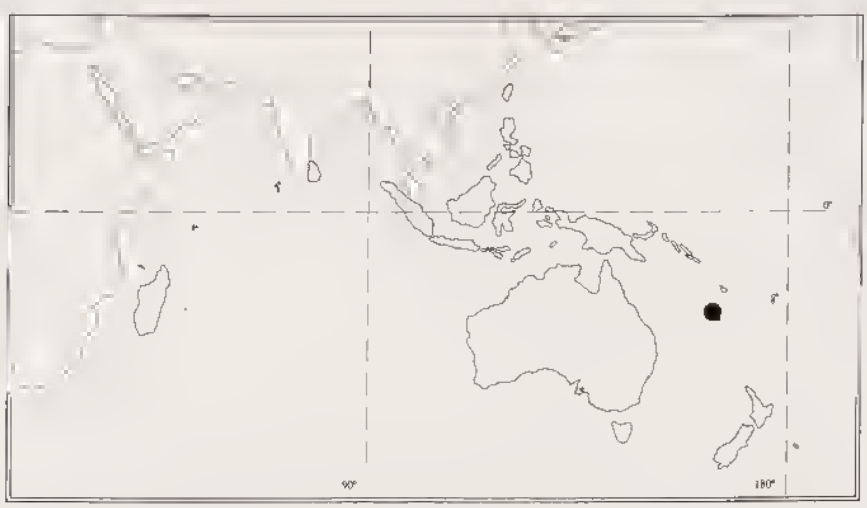


FIG. 124. — Distribution of *Striopulsellum minimum*.

Source : MNHN, Paris

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn KG 16, 20°34' S, 167°22' E, 3680 m, 1 lv.

DISTRIBUTION. — Circumantarctic, now extended to the New Caledonia basin. Alive from 3423 m (PLATE, 1908b) to 6200 m (SCARABINO, 1979).

Other Indo-Pacific species of *Striopulsellum* cited in the literature

Striopulsellum galatheae (Knudsen, 1964): 125, figs 1-2. Sunda Trench, "*Galathea*", stn 465, 10°20' S, 109°55' E, 6900-7000 m. ZMC.

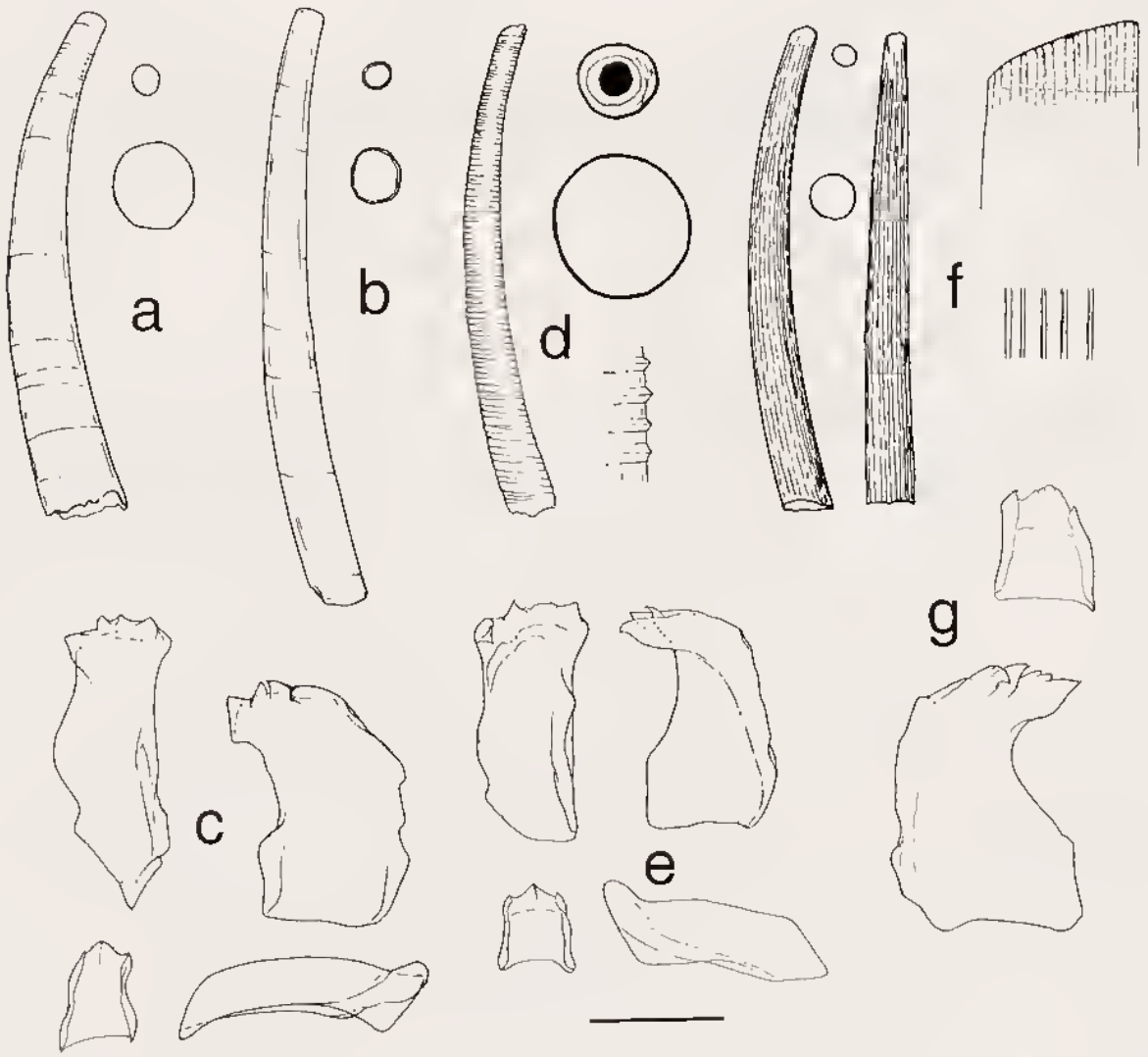


FIG. 125. — **a**, *Pulsellum fragile* sp. nov., holotype, shell (3 mm), apical and oral sections. — **b**, *Pulsellum thomassini* sp. nov., holotype, shell (6 mm), oral and apical sections. — **c**, *Pulsellum* type radula (*P. affine* Sars, 1865, Northeastern Atlantic Ocean). — **d**, *Annulipulsellum euzkadii*, holotype, shell (8.7 mm), apical and oral sections, detail of sculpture. — **e**, *Annulipulsellum* type radula (*A. euzkadii*). — **f**, *Striopulsellum minimum*, shell (5.7 mm), lateral and dorsal views, apical and oral sections, apex and detail of sculpture, BIOCAL: stn KG 16. — **g**, *Striopulsellum* type radula (*S. minimum*).

Source : MNHN, Paris

Family WEMERSONIELLIDAE Scarabino, 1986

Genus *WEMERSONIELLA* Scarabino, 1986

Type species (OD): *W. turnerae* Scarabino, 1986.

DIAGNOSIS. — *Shell* medium to large, straight, white, opaque or polished. Sculpture lacking or with longitudinal undulations on dorsal side. Apex oblique or with two lateral lobes, preapical callus wide, lumen circular. Section slightly ovate to strongly depressed dorsoventrally, oral aperture thin, oblique.
Radula rachidian polygonal with anterior margin simple or with central cusp; laterals strong, with a sharp pointed primary cusp with irregular wrinckle on the outer part of the granulose head; marginals almost straight, pointed at inner margin.

DISTRIBUTION. — Recent, worldwide, abyssal.

REMARKS. — The genus was erected for two abyssal species from the Atlantic Ocean, *W. turnerae* from the North Atlantic in 4125-5150 m, and *W. duartei* Scarabino, 1986a, from the Argentine basin in 5332-5781 m. We add here two new species from the Indo-Pacific. *W. turnerae* is solid while the other three species are fragile.

Wemersoniella indica sp. nov.

Figs 126, 129 a

TYPE MATERIAL. — Holotype MNHN.

TYPE LOCALITY. — West Indian Ocean, BENTHEDI, stn CH 87, 11°44′ S, 47°35′ E, 3716 m.

MATERIAL EXAMINED. — **West Indian Ocean**. BENTHEDI: stn CH 87, 11°44′ S, 47°35′ E, 3716 m, 2 dd (holotype and one other shell that has been accidentally broken after it was photographed).

DISTRIBUTION. — Only known from the type locality.

FIG. 126. — Distribution of *Wemersoniella indica*.

Source : MNHN, Paris

DESCRIPTION. — *Shell* up to 11 mm long straight, fragile, dorsoventrally depressed, rapidly increasing in size from apex to oral aperture, opaque white. Apex simple, oblique from ventral to dorsal side, preapical callus prominent, lumen circular. Maximum diameter at oral aperture. Mouth and prominent growth rings oblique.

Measurements: holotype L 10.2, W 2-1.7, w 0.6-0.5, W/w ratio 3.3.

REMARKS. — Apical and radular characteristics are shared with *Wemersoniella turnerae* and with *W. duartei*, but *W. indica* is much more tapering and compressed than *W. duartei* and more fragile than *W. turnerae*.

ETYMOLOGY. — From Indian Ocean, where this species occurs.

Wemersoniella knudseni sp. nov.

Figs 127, 129 b-c

TYPE MATERIAL. — Holotype ZMC. Paratypes: 2 ZMC, 2 NMNZ M268545, 1 MNHN.

TYPE LOCALITY. — *"Galathea"*, stn 664, Kermadec Trench, 36°34′ S, 178°57′ E, 4510-4570 m.

MATERIAL EXAMINED. — **New Zealand**. *"Galathea"*: stn 602, 43°58′ S, 165°24′ E, 4510 m, 1 lv (paratype ZMC). — Stn 662, 36°22′ S, 178°23′ W, 4630 m, 1 lv (paratype ZMC). — Stn 664, 36°34′ S, 178°57′ W, 4150-4570 m, 2 lv (holotype ZMC and paratype MNHN).
"Tangaroa": stn P 934, 41°31′ S, 165°6′ E, 4405-4411 m, 2 lv (paratypes NMNZ).

FIG. 127. — Distribution of *Wemersoniella knudseni*.

DISTRIBUTION. — Kermadec Trench and Tasman Sea, alive in 4105-4630 m.

DESCRIPTION. — *Shell* up to 12 mm long, straight, fragile, slightly dorsoventrally depressed, porcellaneous white. Apex with two lateral lobes separated by two wide, rounded basal notches, the dorsal one deeper. Maximum diameter at oral aperture. Mouth oblique; oblique growth rings numerous and pronounced in some specimens.

Radula as for the genus.

Measurements: holotype L 11, W 2.5-2.4, w 1.5-1.4; paratypes L 12, W 2.1-2, w 0.99-0.91; L 6, W 1.4-1.1, w 0.65-0.57; L 11.2, W 2-1.5, w 0.99-0.76. W/w ratio 1.6-2.2.

REMARKS. — This species differs from *Wermersoniella indica* in its apical structure and W/w ratio. *W. indica* is more conical. *W. knudseni* is related to *W. turnerae* in the form of the lobes and to *W. duartei* in its fragility and slight dorsoventral compression.

Source : MNHN, Paris

ETYMOLOGY. — Named for Dr Jorgen Knudsen (ZMC) in recognition for his work on the deep-sea Mollusca.

Chistikovia gen. nov.

Type species: *Chistikovia kermadecae* sp. nov.

DIAGNOSIS. — *Shell* medium, straight, fragile, polished, white. Dorsal side straight, ventral side very slightly curved, more noticeably so on the posterior half; lateral sides similarly curved to the ventral. Maximum diameter at anterior third. Unsculptured except for very oblique, conspicuous and close-set growth lines. Apex wide, with subtriangular lobe, margin thin on dorsal side. Section slightly dorsoventrally depressed. Mouth thin, oblique.
Radula similar to that of *Wemersoniella*.

DISTRIBUTION. — Recent, Pacific and Atlantic Oceans, abyssal.

REMARKS. — In addition to *Chistikovia kermadecae*, an undescribed abyssal species from the North Atlantic Ocean belongs to this genus. The general shape of the shell resembles that of *Wemersoniella*, but the apical structures differ. *Chistikovia* is placed in Wemersoniellidae, but the original diagnosis of the family may require modification to include forms with dorsally lobed apex and maximum diameter not exclusively at oral aperture. The last mentioned character can be observed in gerontic stages of *Wemersoniella*.

ETYMOLOGY. — Named for the late Sergei CHISTIKOV (ZIN) for his contribution to the knowledge of Scaphopoda.

Chistikovia kermadecae sp. nov.

Figs 128, 129 d-e

TYPE MATERIAL. — Holotype ZMC. Paratypes: 4 ZMC, 1 MNHN.

TYPE LOCALITY. — *"Galathea"* stn 664, Kermadec Trench, 36°34' S, 178°57' W, 4150-4570 m.

FIG. 128. — Distribution of *Chistikovia kermadecae*.

Source : MNHN, Paris

MATERIAL EXAMINED. — **New Zealand**. "*Galathea*", stn 664, 36°34′ S, 178°57′ W, 4150-4570 m, 3 lv, 2 dd (holotype lv and paratypes ZMC). — Stn 665, 36°38′ S, 178°21′ W, 2470 m, 1 dd (paratype MNHN).

DISTRIBUTION. — Kermadec Trench, alive in 4150-4570 m, shell in 2470 m.

DESCRIPTION. — As for the new genus, dimension up to 11.5 mm.

Measurements: holotype L 11.5, W 2.1, m 1.87, w 1.1-9.3; paratype L 10.2, W 1.9, m 1.7, w 1-0.84.

ETYMOLOGY. — From Kermadec Trench.

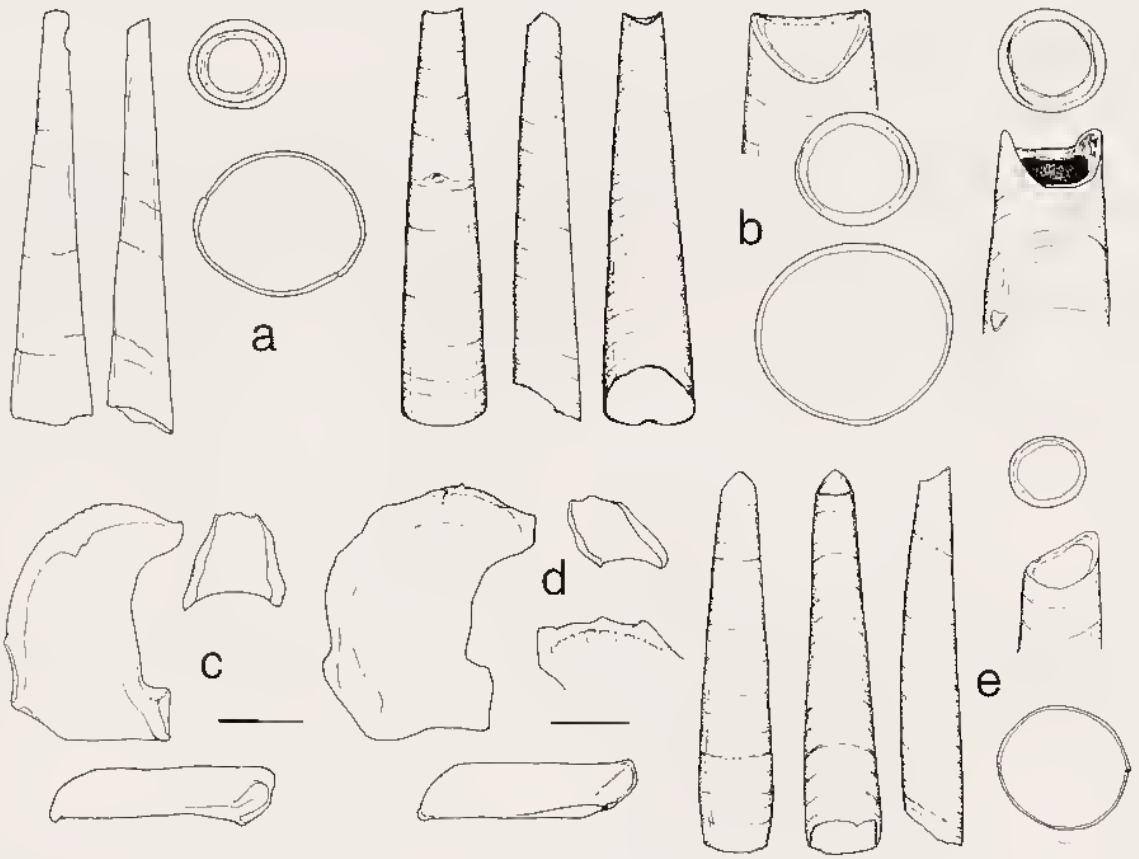


FIG. 129. — **a**, *Wemersoniella indica* sp. nov., holotype, shell (10.2 mm), dorsal and lateral views, apical and oral sections. — **b**, *Wemersoniella knudseni* sp. nov., holotype, shell (11 mm), dorsal, lateral and ventral views, apex, apical and oral sections; at right paratype, apex and apical section. — **c**, *Wemersoniella* type radula (*W. knudseni*). — **d**, *Chistikovia* type radula (*C. kermadecae*). — **e**, *Chistikovia kermadecae* sp. nov., holotype, shell (11.5 mm), dorsal, ventral and lateral views; apex, apical and oral sections.

Family GADILIDAE Stoliczka, 1868

Subfamily SIPHONODENTALIINAE Simroth, 1894

Genus *SIPHONODENTALIUM* M. Sars, 1859

Type species (OD): *Siphonodentalium vitreum* M. Sars, 1859 [= *S. lobatum* Sowerby, 1860]. Recent, Norwegian Sea, Spitzbergen.

Source : MNHN, Paris

DIAGNOSIS. — *Shell* large, strong, polished, white, maximum diameter in anterior 1/3 or near mouth. Sculpture lacking except for longitudinal threads in some species. Circular to subcircular in section. Apex usually strong, with more than four notches and lobes (usually 6). Preapical callus wide, prominent.
Radula rachidian variable in shape, usually with broad base and cusped anterior border; lateral strong with wide head, well armed; marginal usually long [*S. lobatum* Sowerby, 1860, Fig. 135 f; *S. dalli* (Pilsbry & Sharp, 1898), Fig. 135 g].

DISTRIBUTION. — Eocene-Recent, worldwide, shelf-abyssal.

Siphonodentalium colubridens (Watson, 1879)

Figs 130, 135 a

Cadulus colubridens Watson, 1879: 523; 1886: 18, pl. 3, fig. 1.

Other references:

Cadulus colubridens – PILSBRY & SHARP, 1898: 184, pl. 26, fig. 71. — BOISSEVAIN, 1906: 71, pl. 3, fig. 41; pl. 6, fig. 66.
Cadulus (Gadila) colubridens – PLATE, 1908a: 359, pl. 30, fig. 54.
Gadila colubridens – OKUTANI, 1966: 13.

TYPE MATERIAL. — Holotype BMNH 1887.2.9.71.

TYPE LOCALITY. — *"Challenger"*, stn 169, NE Point of New Zealand, 37°34′ S, 179°22′ E, 700 fms [1280 m].

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DC 357, 19°37′ S, 158°46′ E, 630 m, 1 dd.
New Caledonia. BIOCAL: stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 dd.
BIOGEOCAL: stn CP 238, 21°28′ S, 166°23′ E, 1260-1300 m, 1 dd. — Stn DW 313, 20°59′ S, 166°59′ E, 1600-1640 m, 1 dd.
Indonesia. CORINDON: stn DR 231, 00°05′ N, 119°48′ E, 980-1080 m, 1 dd.
Philippines. ESTASE 2: stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 2 dd. — Stn DR 4, 06°08′ N, 125°58′ E, 2800 m, 1 dd. — Stn CP 6, 04°38′ N, 119°49′ E, 2570 m, 4 dd.

FIG. 130. — Distribution of *Siphonodentalium colubridens*.

Source : MNHN, Paris

DISTRIBUTION. — North New Zealand, New Caledonia, Indonesia, the Philippines, Japan in the Pacific Ocean; East Africa, 1280 m (PLATE, 1908) in the Indian Ocean. Depth range 630 to 2800 m (dead).

Siphonodentalium magnum (Boissevain, 1906)

Figs 131, 135 c

Cadulus magnus Boissevain, 1906: 68, pl. 6, fig. 54, textfig. 33.

Other references:

Cadulus (Polyschides) magus (*sic*) – HABE 1964: 12.
Polyschides magnus – HABE, 1963: 278; 1977: 342; 1971: 496 (Japanese text), 313 (English text), pl. 65, figs 28-29. — OKUTANI, 1966: 14, fig. 7. — HABE, *et al.*, 1986: 24. — HIGO & GOTO, 1993: 690.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.092, paralectotypes ZMA 3.06.091, 3.06.093.

TYPE LOCALITY. — "*Siboga*", stn 88, Celebes Sea, 00°35′ S, 119°08′ E, 1301 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOGEOCAL: stn CP 250, 21°25′ S, 166°28′ E, 2350 m, 2 dd.

FIG. 131. — Distribution of *Siphonodentalium magnum*.

DISTRIBUTION. — Southern Japan and Indonesia, now extended to New Caledonia. Shells fom 300 m (HABE, 1964a) to 2350 m (present paper).

Siphonodentalium hexaschistum (Boissevain, 1906)

Figs 132, 135 d

Cadulus hexaschistus Boissevain, 1906: 67, pl. 6, fig. 53, textfig. 33.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.178.

Source : MNHN, Paris

TYPE LOCALITY. — *"Siboga"*, stn 178, Ceram Sea, 02°40′ S, 128°37′ E, 835 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOCAL: stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 dd.
Indonesia. *"Snellius"* II: stn 4.128, 08°18′ S, 118°16′ E, 700-835 m, 1 dd.

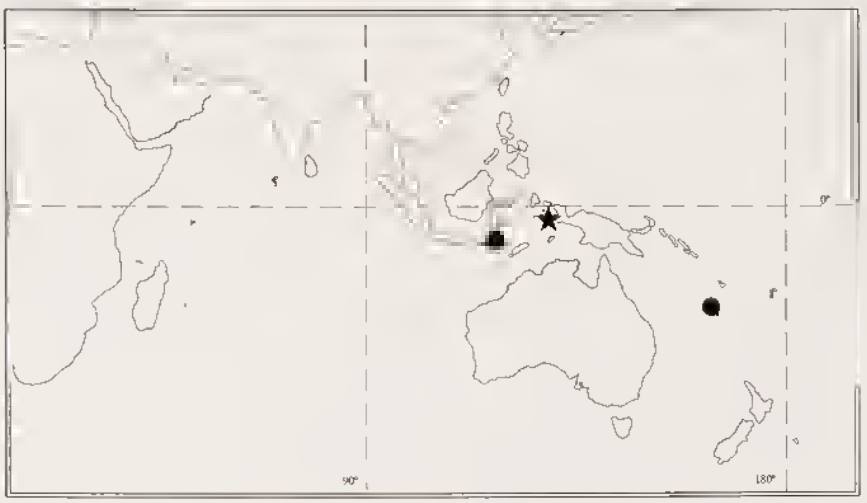


FIG. 132. — Distribution of *Siphonodentalium hexaschistum*.

DISTRIBUTION. — Indonesia, now extended to New Caledonia. Shells in 700 to 1740 m (present paper).

Siphonodentalium promontorii (Barnard, 1963)

Figs 133, 135 b

Cadulus promontorii Barnard, 1963b: 353, figs 30h-l; 1974: 743.

FIG. 133. — Distribution of *Siphonodentalium promontorii*.

Source : MNHN, Paris

TYPE MATERIAL. — Syntypes SAM A7460, and NMW (*fide* OLIVER, 1984).

TYPE LOCALITY. — South Africa, 36 miles of Cape Point, 700 fms [1280 m].

MATERIAL EXAMINED. — The SAM syntypes.
West Indian Ocean. *"Meiring Naudé"*: stn SM 129, 30°53′ S, 30°32′ E, 850 m, 2 dd.

DISTRIBUTION. — Endemic to South Africa, recorded alive in 1100 to 1280 m (BARNARD 1963b), shells from 850 m.

Siphonodentalium jaeckeli sp. nov.

Figs 134, 135 e

TYPE MATERIAL. — Holotype and 1 paratype lv, MNHN.

TYPE LOCALITY. — West Indian Ocean. NW Madagascar, BENTHEDI, stn DS 03, 12°35′ S, 47°38′ E, 1100-1150 m.

MATERIAL EXAMINED. — Only known from the type material.

FIG. 134. — Distribution of *Siphonodentalium jaeckeli*.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* to 11 mm long, strong, shiny, white. Equator in anterior third, dorsoventrally compressed in section. Apex subcircular, dorsoventrally compressed, with five lobes, the largest ventral, two laterals and two dorsal. Subapical callus prominent, lumen circular. Mouth simple, subcircular, slightly laterally compressed in section.
Measurements: holotype L 11, W 2.72-2.51, m 1.6-1.5, w 1.2-1.1.

REMARKS. — The apical area, short and wide, almost without neck, is the main distinguishing feature of this species.

ETYMOLOGY. — Named for S. JAECKEL, who studied the scaphopods of the Indian Ocean collected by the German *"Valdivia"* Expedition, 1898-1899.

Source : MNHN, Paris

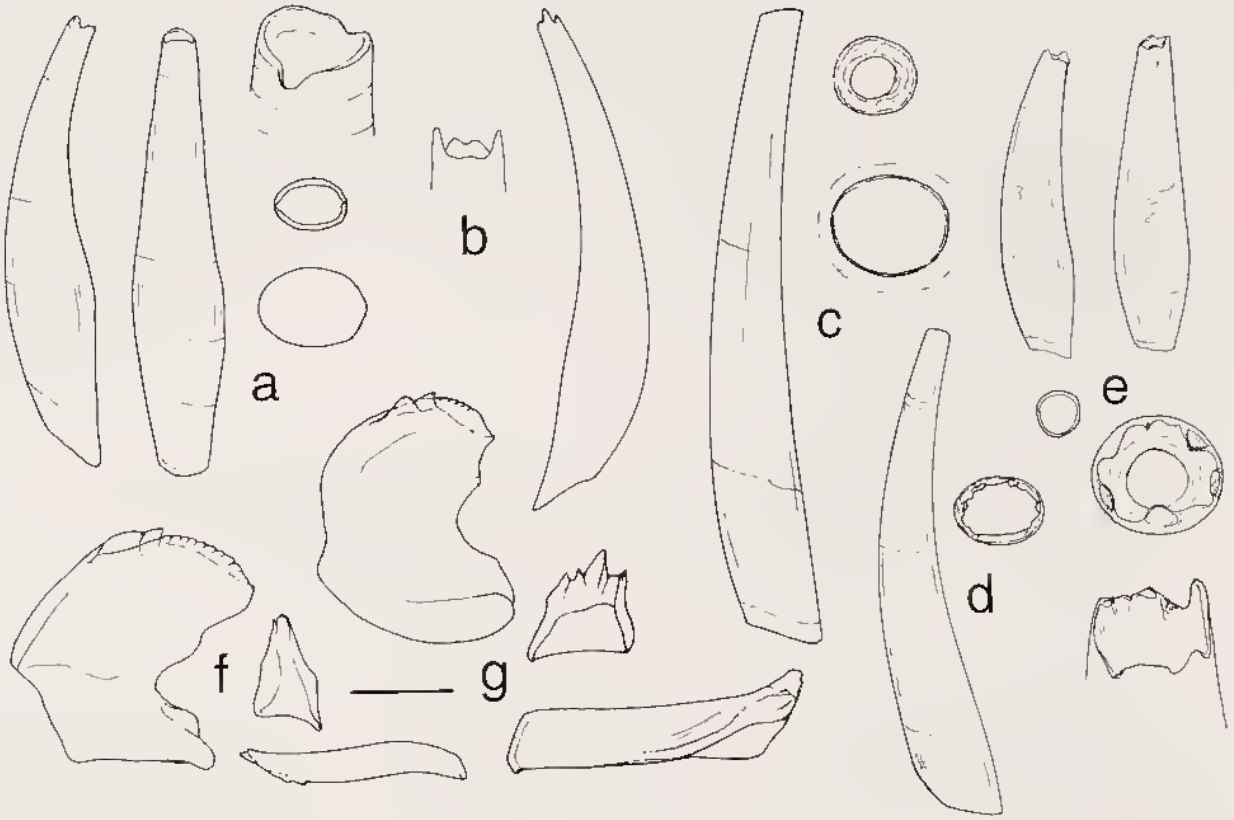


FIG. 135. — **a**, *Siphonodentalium colubridens*, shell (15 mm), lateral and dorsal views, apex, apical and oral sections, MUSORSTOM 5: stn DC 357. — **b**, *Siphonodentalium promontorii* (after BARNARD, 1963, fig. 30). — **c**, *Siphondentalium magnum*, shell (26 mm), apical and oral sections, BIOGEOCAL: stn CP 250. — **d**, *Siphonodentalium hexaschistum*, shell (14 mm) and apical section, *"Snellius"*II, stn 4.128. — e, *Siphonodentalium jaeckeli* sp. nov., holotype, shell (11 mm), lateral and dorsal views, apex, apical and oral sections. — **f-g**, *Siphonodentalium* type radula. — **f**, *S. lobatum* (North Atlantic Ocean). — **g**, *S. dalli* (Antarctic).

Other Indo-Pacific species of *Siphonodentalium* cited in the literature

Siphonodentalium australasiae Boissevain, 1906: 64, pl. 6, fig. 68. *"Siboga"*, stn 211, 05°41′ S, 120°46′ E, Banda Sea, 1158 m. Syntype ZMA.

Siphonodentalium booceras (Tomlin, 1926): 298, pl. 15, fig. 11. South Africa, Congella. SAM and NMW (*fide* TREW, 1990).

Siphonodentalium (?) *delicatulum* (Suter, 1913): 823, pl. 32, fig. 7. Southern New Zealand, Milford Sound, 100-120 fms [183-220 m]. New Zealand Geological Survey, Wellington (*fide* DANCE, 1986).

Siphonodentalium isaotakii Habe, 1953: 299. Tokyo Bay, Honshu, Japan. NSMT.

Siphonodentalium japonicum Habe, 1960: 294. Amakusa Island, Kyushu, Japan. NSMT.

Siphonodentalium longilobatum (Boissevain, 1906): 68, pl. 6, figs 55-56. Indonesia, *"Siboga"*, stn 133, off Lirung, Salibabu Island, 36 m. 3 syntypes ZMA.

Siphonodentalium okudai Habe, 1953: 299, figs 759-760. Akkeshi Bay, Hokkaido, Japan. NSMT.

Source : MNHN, Paris

Genus *Sagamicadulus* Sakurai & Shimazu, 1963

Fig. 139 a

Type species (by monotypy): *Striocadulus* (*Sagamicadulus*) *elegantissimus* Sakurai & Shimazu, 1963.

Diagnosis. — *Shell* small to medium, thin, translucent white, glassy. Maximum diameter at the anterior third. Surface smooth at apical portion, striated in median and anterior areas. Apex round in section, with five lobes, two ventral and one flat, dorsal. Mouth ellipsoidal in section, dorsoventrally compressed.
Radula unknown, assumed to be similar to that of *Siphonodentalium*.

Distribution. — Japan, shelf.

The genus *Sagamicadulus* is not represented in the material here reported on.

The type species is the only Indo-Pacific species: *Sagamicadulus elegantissimus* (Sakurai & Shimazu, 1963): 250, textfig. 1. Sagami Bay, Japan, 55-128 m. NSMT.

Genus *Striocadulus* Emerson, 1962

Type species (OD): *Cadulus albicomatus* Dall, 1890. Recent, Ecuador, 401 fms [773 m].

Diagnosis. — *Shell* medium to large, strong, polished, white, maximum diameter in anterior third. Sculptured with numerous close, fine, longitudinal striae throughout. Subcircular in section, dorsoventrally compressed. Apex strong, with two weak, flat lateral lobes, preapical callus prominent. *Radula* similar to that of *Siphonodentalium*.

Distribution. — Recent, Pacific and Indian Ocean, absent in the Atlantic Ocean. Shelf-bathyal.

Striocadulus pulcherrimus (Boissevain, 1906)

Figs 136, 139 b

Cadulus pulcherrimus Boissevain, 1906: 74, pl. 6, figs 58-59.

Other reference:
Cadulus (Gadila) pulcherrimus – Habe & Kosuge, 1964: 11.

Type material. — Lectotype (here designated) ZMA 3.06.104, paralectotypes ZMA 3.06.105.

Type locality. — *"Siboga"*, stn 314, Flores Sea, 07°36' S, 117°31' E, 694 m.

Material examined. — The type material.
Indonesia. CORINDON: stn B 275, 01°54' S, 119°14' E, 530 m, 1 lv, 2 dd.

Distribution. — Indonesia, alive in 530-694 m.

Source : MNHN, Paris

FIG. 136. — Distribution of *Striocadulus pulcherrimus*.

Striocadulus sagei sp. nov.

Figs 137, 139 d-e, 172 c-d

TYPE MATERIAL. — Holotype and 4 paratypes MNHN.

TYPE LOCALITY. — Philippines, MUSORSTOM 2, stn CP 24, 13°37′ N, 120°42′ E, 640-647 m.

MATERIAL EXAMINED. — **Indonesia**. *"Snellius"* II: stn 4.128, 08°18′ S, 118°16′ E, 700-835 m, 1 dd. — Stn 4.130, 08°18′ S, 118°19′ E, 700-730 m 3 lv, 9 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 680-800 m 1 lv, 2 dd (RMNH).
Philippines. MUSORSTOM 2: stn CP 24, 13°37′ N, 120°42′ E, 640-647 m, 5 lv (holotype and paratypes). — Stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 3 dd.

FIG. 137. — Distribution of *Striocadulus sagei*.

DISTRIBUTION. — The Philippines and Indonesia, alive in 640-800 m, shells from 550 m.

Source : MNHN, Paris

DESCRIPTION. — *Shell* to 43 mm long, strong, polished, white, maximum diameter near the oral aperture. Longitudinal sculpture of numerous close, fine, flat round-section riblets, crossed throughout by growth lines. Apex wide, slightly dorsoventrally compressed, with two wide lateral lobes. Oral aperture oblique, dorsoventrally compressed.

Measurements: holotype L 40, W 4.5, m 3.9, w 1.6, arc 3; paratypes L 40, W 4.5, m 4, w 1.9, arc 3; L 43, W 4.6.1, m 4, w 1.8, arc 3; L 39.5, W 4.8, m 4.4, w 1.5, arc 3.5; L 40.2, W 4.6, m 4, w 1.7, arc 4.

REMARKS. — This is the largest species in the order Gadilida. *Siphonodentalium magnum* (Boissevain, 1906) has no sculpture and its apex is circular in section with traces of four flat, irregular lobes. Other species of Gadilidae with longitudinal sculpture are *S. striatulus* (Pilsbry & Sharp, 1898) and *S. albiconnatus* (Dall, 1990) from Western North America, *S. pulcherrimus*, *S. lubrooki* (here described) and *Sagamicadulus elegantissimus* from Japan.

ETYMOLOGY. — Named for Walter SAGE (AMNH), who kindly reviewed linguistically my manuscript.

Striocadulus ludbrooki sp. nov.

Figs 138, 139 c

Cadulus (Polyschides) hexaschistus – LUDBROOK, 1954: 118, fig. 14. [not *C. hexaschistus* Boissevain, 1906]

TYPE MATERIAL. — Holotype and 3 paratypes BMNH 1952.3.25.342-345.

TYPE LOCALITY. — Gulf of Aden, *"John Murray"*, stn 176, 12°05' N, 50°38' E, 655-732 m.

MATERIAL EXAMINED. — **Northwestern Indian Ocean**. *"John Murray"*: stn 176, 12°05' N, 50°38' E, 655-732 m, 2 dd (holotype and paratype). — Stn 188, 13°46' N, 47°50' E, 528 m, 2 dd (paratypes).

FIG. 138. — Distribution of *Striocadulus ludbrooki*.

DISTRIBUTION. — Northern Indian Ocean, shells in 528-732 m.

DESCRIPTION. — *Shell* to 20 mm, translucent, shiny, ventral side regularly curved, dorsal with a swell at first fourth, also observed in frontal view. Apex with two wide, flat lobes, section oval, dorsoventrally compressed. Sculpture by longi-

Source : MNHN, Paris

ludinal striae, more prominent in first 3/4. Mouth oblique, subcircular in section.

Measurements: holotype L 19.5, W 3, m 2, w 1.4; paratype L 20, W 2.8, m 2.3, w 1.2.

REMARKS. — This species is much less tapering than *Striocadulus pulcherrimus* and shorter and less sculptured than *S. sagei*, the other two Indo-Pacific species of the genus.

ETYMOLOGY. — Named after Neils LUDBROOK, who studied the scaphopods taken during the *"John Murray"* expedition (1933-34) in the NW Indian Ocean.

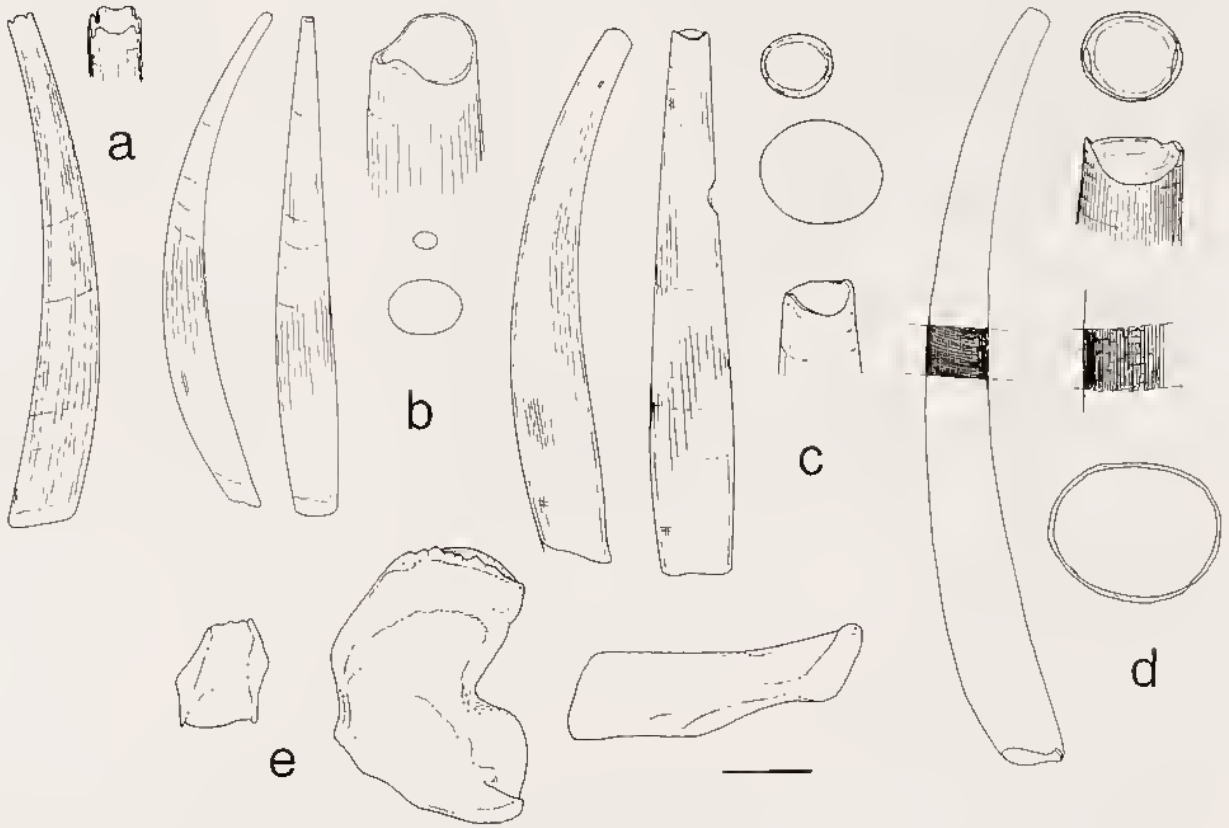


FIG. 139. — **a**, *Sagamicadulus elegantissiums* (after HABE, 1964, pl. 5, figs 45-46), shell and apex. — **b**. *Striocadulus pulcherrimus*, shell (16 mm), lateral and dorsal views, apex, apical and oral sections, CORINDON: stn B 275. — **c**, *Striocadulus ludbrooki*, holotype, shell (19.5 mm), lateral and dorsal views, apical and oral sections, apex. — **d**, *Striocadulus sagei* sp. nov., holotype, shell (40 mm), apical section, apex, detail of sculpture, oral section. — **e**, *Striocadulus* type radula (*S. sagei*).

Genus *POLYSCHIDES* Pilsbry & Sharp, 1898

Type species (OD): *Cadulus tetraschistus* Watson, 1879. Recent, West Atlantic Ocean, *"Challenger"*, off Fernando de Noronha, stn 113a, 03°47' S, 32°24' W, 7-25 fms [13-47 m].

DIAGNOSIS. — *Shell* small to medium, strong, smooth, white, translucent when fresh, polished when dead. Maximum diameter located in anterior third or in the mouth area. Apex wide, with four deep notches and four lobes, two laterals, one dorsal, one ventral. Preapical callus weak.
Radula rachidian subpyramidal with wide base; lateral with two sharp cusps on inner surface, one on outer face; marginal short.

DISTRIBUTION. — Eocene-Recent, worldwide, littoral-bathyal.

Source : MNHN, Paris

Polyschides pelamide Chistikov, 1979

Figs 140, 147 a

Polyschides pelamide Chistikov, 1979b: 143. fig. 7.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV).

TYPE LOCALITY. — Gulf of Tonking, South China Sea, 56 m.

MATERIAL EXAMINED. — **Indonesia**. CORINDON: stn B 204, 01°09′ S, 117°18′ E, 49 m, 1 lv, 8 dd. — Stn B 207, 00°15′ S, 117°52′ E, 150 m, 4 dd. — Stn B 251, 00°54′ S, 119°30′ E, 65 m, 4 dd. **Philippines**. MUSORSTOM 3: stn DR 140, 11°43′ N, 122°34′ E, 93-99 m, 71 dd.

FIG. 140. — Distribution of *Polyschides pelamide*.

DISTRIBUTION. — Viet-Nam, now extended to the Philippines and Indonesia, alive in 49-56 m, shells down to 150 m (present paper).

Polyschides arnaudi sp. nov.

Figs 141, 147 b, h

TYPE MATERIAL. — Holotype MNHN. Paratypes: 13 MNHN, 1 NMP, 1 USNM.

TYPE LOCALITY. — West Indian Ocean, MD 32 Réunion, stn DC 124, 20°52′ S, 55°37′ E, 40 m.

MATERIAL EXAMINED. — **West Indian Ocean**. MD 32 Réunion: stn DC 10, 21°13′ S, 55°52′ E, 930-980 m, 1 dd. — Stn DR 47, 21°23′ S, 55°37′ E, 205-215 m, 1 dd. — Stn DC 56, 21°05′ S, 55°12′ E, 170-225 m, 26 dd. — Stn DC 85, 21°00′ S, 55°15′ E, 58-70 m, 7 dd. — Stn DC 86, 20°59′ S, 55°15′ E, 75-90 m, 7 lv, 38 dd. — Stn DR 90, 19°45′ S, 54°09′ E, 65 m, 3 dd. — Stn DC 124, 20°52′ S, 55°37′ E, 40 m, 13 lv, 129 dd (holotype dd, paratypes: 7 lv, 6 dd MNHN, 1 dd NMP, 1 dd USNM). — Stn DC 136, 20°46′ S, 55°36′ E, 915-922 m, 9 dd. — Stn DC 176, 21°02′ S, 55°11′ E, 165-195 m, 1 dd.

Source : MNHN, Paris

FIG. 141. — Distribution of *Polyschides arnaudi*.

DISTRIBUTION. — Only known from Réunion Island. Alive in 40-90 m, shells (probably washed down) to 980 m.

DESCRIPTION. — *Shell* to 42 mm long, translucent, shiny, smooth. Maximum diameter at anterior 1/8 of shell, swollen at anterior aperture. Apex oval dorsoventrally, wide, with four lobes created by four notches. The latero-dorsal notch is deeper, forming a wide, flat dorsal lobe; two lobes are lateral; the fourth is ventral, higher and posteriorly rounded. Preapical callus prominent, lumen oval. Oral aperture circular, slightly oblique.

Measurements: holotype L 7.5, W 1.2, w 0.9, apex 0.6; paratypes L 6.4, W 1.2, w 0.7, apex 0.5; L 7.9, W 1.3, w 1, apex 0.6; L 7.6, W 1.3, w 0.9, apex 0.5.

REMARKS. — The shell is characterized by alternating white and translucent rings throughout. *Polyschides arnaudi* resembles the Western Atlantic *P. tetrodon* (Henderson, 1920), from which it differs in having a less fusiform shell sape.

ETYMOLOGY. — Named for Dr Patrick M. ARNAUD, Centre Océanologique de Marseille.

Other Indo-Pacific species of *Polyschides* cited in the literature

Polyschides faustus (Kuroda & Habe *in* Habe, 1971): 496 (Japanese text), 313 (English text), pl. 65, figs 18-19. Sagami Bay, Japan.

Polyschides kaiyomaruae Okutani, 1975: pl. 3, fig. 5. N W Pacific, 29°49′ N, 147°09′ E to 28°48′ N, 147°09′ E, 6200 m.

Polyschides sakuraii (Kuroda & Habe *in* Habe, 1962): 105, pl. 47, fig. 3. Off Choshi, Chiba Prefecture, Honshu, Japan, 200 m. NSMT.

Polyschides vietnamicus Chistikov, 1979b: 113, fig. 6. Tonking Bay, Viet Nam, 8 m. ZIN.

Genus *DISCHIDES* Jeffreys, 1867

Type species (by monotypy): *Dentalium bifissum* Wood, 1842. Recent, Mediterranean and East Atlantic; Pliocene of England and Italy.

DIAGNOSIS. — *Shell* small to medium sized, strong, smooth, white, translucent when fresh, shiny when dead. Maximum diameter in anterior half of the shell or near the mouth. Apex wide, with

Source : MNHN, Paris

two deep lateral notches and two lobes, the ventral larger, usually with a central nodule in the inner wall. Preapical callus weak.
Radula similar to that of *Polyschides*.

DISTRIBUTION. — Eocene-Recent, worldwide, well represented in the Indo-Pacific region, littoral-bathyal.

Dischides minutus (H. Adams, 1872)
Figs 111 n-o, 142, 147 c

Cadulus minutus H. Adams, 1872: 10, pl. 3, fig. 9.

Other references:
Dentalium minutus — SOWERBY, 1873: pl. 7, fig. 48. — COOKE, 1885: 273.
Cadulus minutus — PILSBRY & SHARP, 1897: 188, pl. 26, fig. 78. — BOISSEVAIN, 1906: 67, pl. 3, fig. 49.

TYPE MATERIAL. — Presumably in BMNH (not located).

TYPE LOCALITY. — Red Sea.

MATERIAL EXAMINED. — **Red Sea**. Suez, 145 dd. — Gulf of Suez, 15 dd. — Souakin, Sudan, 3 dd. — Djeddah, 1 dd. — Aden, 65 dd (all Coll. JOUSSEAUME, MNHN).

FIG. 142. — Distribution of *Dischides minutus*.

DISTRIBUTION. — Red Sea and Gulf of Aden. Depth distribution unknown, shells probably washed ashore.

Dischides dichelus (Watson, 1879)
Figs 143, 147 e

Siphonodentalium dichelum Watson, 1879: 521; 1886: 15, pl. 2, fig. 7.

Other references:
Cadulus dichelus — PILSBRY & SHARP, 1898: 145, pl. 26, fig. 73. — BOISSEVAIN, 1906: 65, pl. 3, fig. 48, pl. 6, fig. 51.
C. (Dischides) dichelus — HABE & KOSUGE, 1964: 11.

Source : MNHN, Paris

TYPE MATERIAL. — Holotype BMNH 1887.2.9.65.

TYPE LOCALITY. — *"Challenger"*, Levuka, Fiji, 12 fms [22 m].

MATERIAL EXAMINED. — The type material.
West Indian Ocean. MD 32 Réunion: stn DC 56, 21°05′ S, 55°12′ E, 170-225 m, 2 lv, 254 dd. — Stn DC 85, 21°00′ S, 55°15′ E, 58-70 m, 2 dd. — Stn 90, 19°45′ S, 54°09′ E, 65 m, 1 dd. — Stn CP 129, 20°51′ S, 55°36′ E, 290-300 m, 1 dd.
NW Madagascar, Nosy Bé Island, PLANTE coll., 1 lv, 2 dd (BMNH).

FIG. 143. — Distribution of *Dischides dichelus*.

DISTRIBUTION. — Fiji and Indonesia (BOISSEVAIN, 1906), now extended to Réunion Island and Madagascar; alive in 170-225 m and in indeterminate condition up to 22 m.

Dischides prionotus (Watson, 1879)

Figs 144, 147 d, i

Siphonodentalium prionotum Watson, 1879: 522; 1886: 16, pl. 2, fig. 9.

Other references:
Cadulus prionotus — PILSBRY & SHARP, 1898: 146, pl. 26, fig. 74. — BOISSEVAIN, 1906: 66, pl. 3, fig. 47.

TYPE MATERIAL. — 3 syntypes dd BMNH 1907.10.28.147-149.

TYPE LOCALITY. — *"Challenger"*, stn 185b, 11°38′ S, 143°59′ E, 155 fms [283 m], off Cape York, N Australia.

MATERIAL EXAMINED. — The type material.
New Caledonia. *"Vauban"* 1978-79: stn 33, 22°33′ S, 166°25′ E, 290-350 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DR 08, 11°29′ S, 47°18′ E, 250 m, 5 lv, 4 dd. — Stn DS 10, 11°29′ S, 47°18′ E, 440 m, 1 lv, 1 dd. — Stn DS 64, 12°41′ S, 44°57′ E, 770-860 m, 1 lv. — Stn DS 72, 12°31′ S, 45°02′ E, 300-350 m, 1 lv, 2 dd. — Stn DS 94, 11°32′ S, 47°16′ E, 450 m, 1 lv. — Stn DS 120, 11°30′ S, 47°25′ E, 335-390 m, 5 lv, 3 dd.

Source : MNHN, Paris

MD 32 Réunion: stn DC 85, 20°59′ S, 55°15′ E, 58-70 m, 2 dd. — Stn DC 128, 20°51′ S, 55°36′ E, 280-340 m, 1 dd.

FIG. 144. — Distribution of *Dischides prionotus*.

DISTRIBUTION. — N Australia, now extended to New Caledonia, Réunion Island and NW Madagascar, alive in 250-450 m and shells from 70 m.

Dischides viperidens (Melvill & Standen, 1896)

Figs 145, 147 f

Cadulus viperidens Melvill & Standen, 1896: 314, pl. 11, fig. 79.

TYPE MATERIAL. — Figured syntype Manchester Museum EE 3797; 6 other syntypes NMW (TREW, 1987).

FIG. 145. — Distribution of *Dischides viperidens*.

Source : MNHN, Paris

TYPE LOCALITY. — Lifu and Uvea, Loyalty Islands, New Caledonia.

MATERIAL EXAMINED. — **Loyalty Islands**. Niemak, Ouvéa, beach, 27 July 1978, P. Bouchet coll., 25 dd.

DISTRIBUTION. — Loyalty Islands, shore.

Dischides yateensis sp. nov.

Figs 146, 147 g

TYPE MATERIAL. — Holotype and paratype MNHN.

TYPE LOCALITY. — New Caledonia, LAGON, stn 619, 22°03′ S, 166°54′ E, 27-42 m.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 619, 22°03′ S, 166°54′ E, 27-42 m, 2 dd (holotype and paratype).
Philippines. Coll. JOUSSEAUME, 6 dd, MNHN.

FIG. 146. — Distribution of *Dischides yateensis*.

DISTRIBUTION. — New Caledonia and the Philippines. Shells from the shore to 42 m.

DESCRIPTION. — *Shell* to 13 mm long, strong, shiny, translucent white. Maximum diameter in anterior fifth, where a slight swelling originates near the mouth and rapidly curves towards the peristome; growth lines pronounced. Apex strong, wide, dorsoventrally compressed, with two lateral notches forming two lobes, the dorsal with a rounded edge and the ventral angled with a prominent central denticle. Preapical callus prominent, lumen circular. Mouth straight, oval dorsoventrally.

Measurements: holotype L 12.4, W 2-1.9, m 1.5-1.4, apex 0.9-0.8, arc 0.5; paratype L 12.1, W 2, m 1.8-1.65, apex 0.9-0.8, arc 0.5.

REMARKS. — This species resembles *Dischides prionotus*, which has similar sculpture but different shape, and *D. dichelus*, which is fusiform in outline. The three species share the denticle situated on the ventral lobe of the apex.

ETYMOLOGY. — Named for Yaté, the type locality.

Source : MNHN, Paris

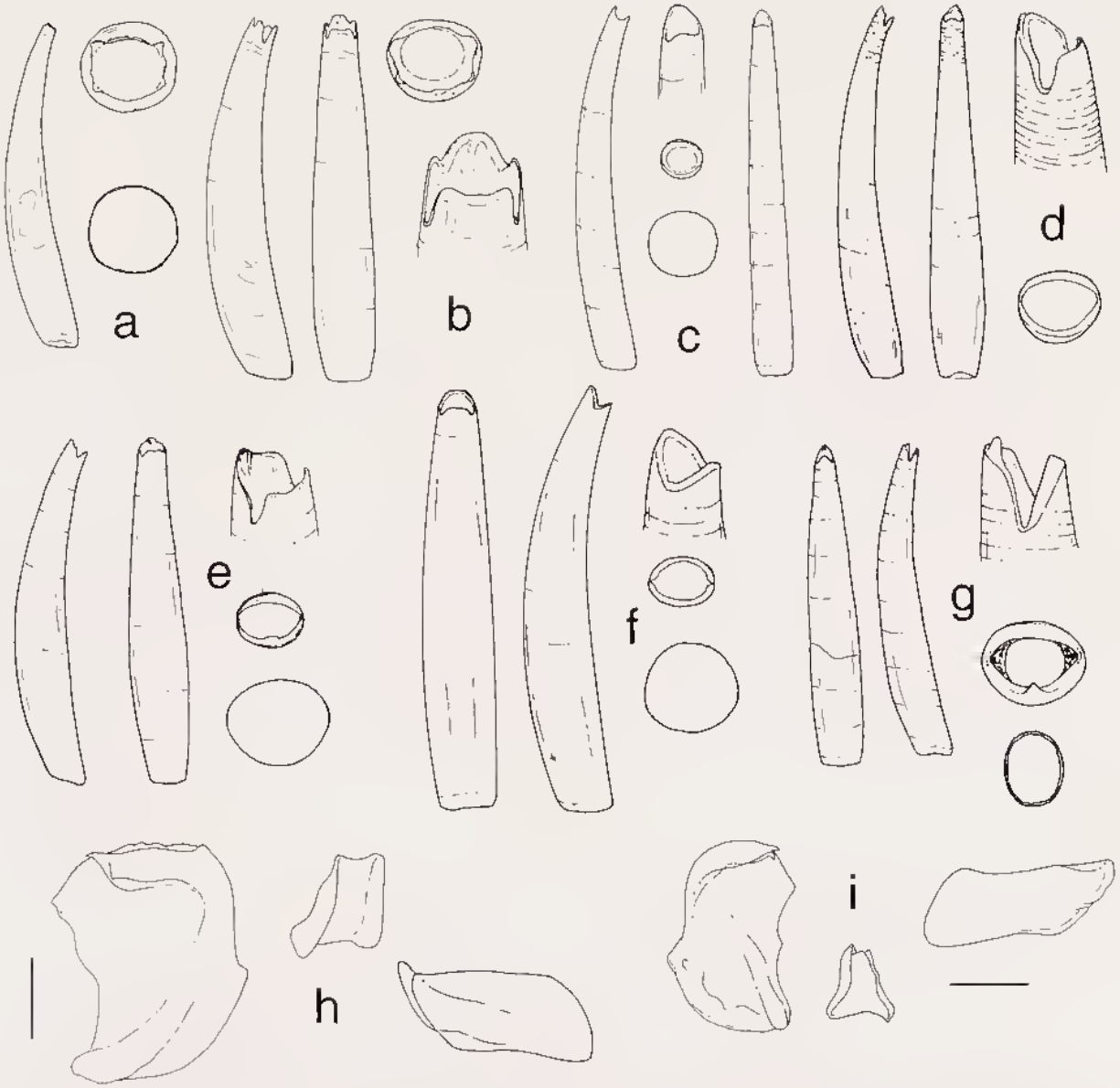


FIG. 147. — **a**, *Polyschides pelaniae*, shell (11.5 mm), apical and oral sections, MUSORSTOM 3: stn DR 140. — **b**, *Polyschides arnaudi* sp. nov., holotype, shell (7.5 mm) lateral and dorsal views, apex and apical section. — **c**, *Dischides minutus*, shell (5 mm), apex, apical and oral sections, Aden (MNHN). — **d**, *Dischides prionotus*, shell (12 mm), lateral and dorsal views, apex and apical sections, BENTHEDI: stn DS 120. — **e**, *Dischides dichelus*, shell (9 mm), lateral and dorsal views, apex, apical and oral sections, MD 32 Réunion: stn DC 56. — **f**, *Dischides viperidens*, shell (6 mm), dorsal and lateral views, apex, apical and oral sections, Loyalty Islands (MNHN). — **g**, *Dischides yateensis* sp. nov., holotype, shell (12.4 mm), dorsal and lateral views, apex, apical and oral sections. — **h**, *Polyschides* type radula (*P. arnaudi*). — **i**, *Dischides* type radula (*D. prionotus*).

Source : MNHN, Paris

Subfamily GADILINAE Stoliczka, 1868

Genus *CADULUS* Philippi, 1844

Type species (by monotypy): *Cadulus ovulum* Philippi, 1844. Recent, Mediterranean Sea.

DIAGNOSIS. — *Shell* small to medium, swollen, solid, smooth, white, translucent when fresh, shiny when dead. Maximum diameter in center of shell. Apex simple or coronate, preapical callus usually prominent, lumen circular. Apical and oral sections variable, usually oval dorsoventrally or laterally compressed.
Radula rachidian variable, polygonal to almost quadrangular, anterior margin generally with cusps; lateral with two to three primary cusps with a series of denticles between cusps; marginal short, slightly curved (Fig. 160 k, *C. tumidosus* Jeffreys, 1877).

DISTRIBUTION. — Cretaceous-Recent, worldwide, shelf-abyssal.

Cadulus simillimus Watson, 1879

Figs 148, 160 a

Cadulus simillimus Watson, 1879: 526; 1886: 20, pl. 3, fig. 6.

Other references:
Cadulus simillimus — BOISSEVAIN, 1906: 69, pl. 3, fig. 46.
Cadulus (Gadila) simillima — HABE & KOSUGE, 1964: 11.

TYPE MATERIAL. — 2 syntypes dd, BMNH 1887.2.9.80-81.

TYPE LOCALITY. — Australia, off Cape York, Queensland, *"Challenger"*, stn 185b, 11°38' S, 143°59' E, 155 fms [283 m].

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn KG 201, 22°40' S, 166°33' E, 595 m, 1 dd. — Stn KG 219, 22°39' S, 166°34' E, 570 m, 2 dd.
North Australia. Port Darwin, Coll. DENIS, 2 dd (MNHN).

FIG. 148. — Distribution of *Cadulus simillimus*.

Source : MNHN, Paris

DISTRIBUTION. — Northern Australia, now extended to New Caledonia, shells from 6 fms [11 m] (WATSON, 1879) to 595 m (present paper).

Cadulus aratus Hedley, 1899

Figs 149, 160 b

Cadulus aratus Hedley, 1899b: 551, fig. 60.

TYPE MATERIAL. — Syntypes AMS C5635, 36, 38.

TYPE LOCALITY. — Pacific Ocean, Tuvalu, Funafuti Atoll, 66 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. LAGON: stn 729, 21°194 S, 165°54′ E, 42-45 m, 1 dd.
Philippines. MUSORSTOM 2: stn DR 33, 13°32′ N, 121°08′ E, 130-137 m, 3 dd.
West Indian Ocean. BENTHEDI: stn DS 120, 11°30′ S, 47°25′ E, 335-390 m, 10 lv. MD 32 Réunion: stn DS 178, 21°04′ S, 55°10′ E, 412-460 m, 2 lv.

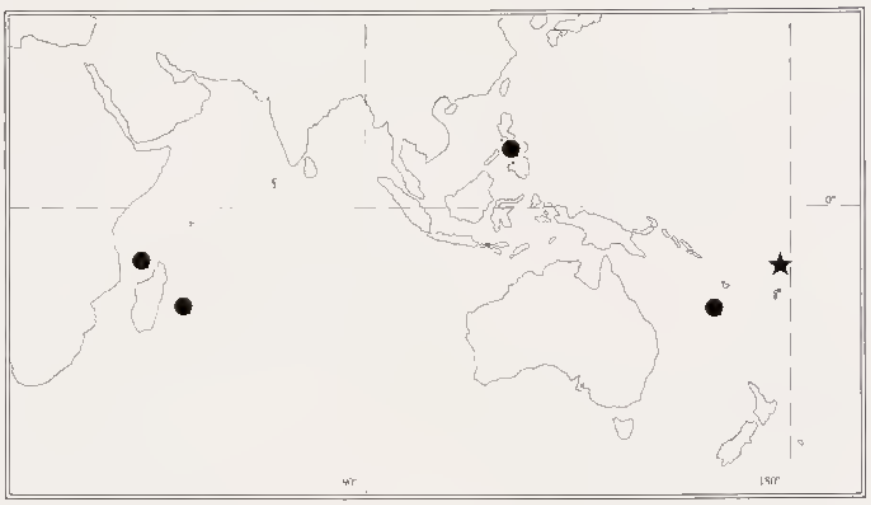


FIG. 149. — Distribution of *Cadulus aratus*.

DISTRIBUTION. — Funafuti Atoll, now extended to New Caledonia, the Philippines, Réunion Island and NW Madagascar, alive in 335-460 m, shells recorded as shallow as 45 m.

Cadulus aequatorialis Jaeckel, 1932

Figs 150, 160 c

Cadulus aequatorialis Jaeckel, 1932: 311, textfig. 10.

Other reference:
Cadulus (C.) aequatorialis – HABE & KOSUGE, 1964: 9.

TYPE MATERIAL. — Lectotype (KILIAS, 1972) ZMB 75372, paratype 75373.

TYPE LOCALITY. — Indonesia, West Sumatra, "*Valdivia*", stn 191, 00°39′ S, 98°52′ E, 750 m.

Source : MNHN, Paris

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn CP 214, 22°43′ S, 166°28′ E, 1590-1665 m, 1 dd. — Stn KG 221, 22°42′ S, 166°24′ E, 1915 m, 1 lv.

FIG. 150. — Distribution of *Cadulus aequatorialis*.

DISTRIBUTION. — Indonesia, now extended to New Caledonia, alive in 1915 m, shells from 750 m.

Cadulus cyathoides Jaeckel, 1932

Figs 151, 152, 160 d

Cadulus cyathoides Jaeckel, 1932: 308, textfig. 5.

Other reference:
Cadulus (C.) cyathoides — LUDBROOK, 1954: 112, fig. 12.

TYPE MATERIAL. — Lectotype, designated by KILIAS (1995), ZMB 75361a.

TYPE LOCALITY. — Indonesia, West Sumatra, *"Valdivia"*, stn 191, 00°39′ S, 98°52′ E, 750 m.

FIG. 151. — *Cadulus cyathoides*, detail of the coronale apex common to all globose *Cadulus*. Scale line: 100 µm.

Source : MNHN, Paris

MATERIAL EXAMINED. — **Philippines**. ESTASE 2: stn CP 2, 14°05′ N, 120°02′, 2050 m, 2 dd. MUSORSTOM 3: stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 1 lv.
West Indian Ocean. BENTHEDI: stn 42, 13°05′ S, 45°08′ E, 400-520 m, 1 lv.

FIG. 152. — Distribution of *Cadulus cyathoides*.

DISTRIBUTION. — Red Sea, Gulf of Aden (LUDBROOK, 1954) and Indonesia, now extended to the Philippines, alive in 205-520 m and shells down to 2050 m (present paper).

Cadulus chuni Jaeckel, 1932
Figs 153, 160 e

Cadulus chuni Jaeckel, 1932: 309, textfig. 6.
Other reference:
Cadulus (C.) chuni – HABE & KOSUGE, 1964: 10.

FIG. 153. — Distribution of *Cadulus chuni*.

Source : MNHN, Paris

TYPE MATERIAL. — Lectotype, designated by KILIAS (1995), ZMB 75374a.

TYPE LOCALITY. — East Africa, off Somalia, *"Valdivia"*, stn 256, 01°49′ N, 45°30′ E, 1134 m.

MATERIAL EXAMINED. — **Indonesia**. *"Snellius"* II: stn 4.112, 08°19′ S, 118°16′ E, 365 m, 20 lv, 18 dd.
Philippines. MUSORSTOM 3: stn CP 139, 11°53′ N, 122°14′ E, 240-267 m, 1 lv, 1 dd. — Stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 3 lv, 15 dd.

DISTRIBUTION. — East Africa, now extended to Indonesia and the Philippines, alive in 205 to 365 m.

Cadulus martini sp. nov.

Figs 154, 160 f

TYPE MATERIAL. — Holotype and 6 paratypes MNHN.

TYPE LOCALITY. — New Caledonia, BIOGEOCAL, stn CP 232, 21°34′ S, 166°27′ E, 760-790 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 1 lv (paratype), 3 dd (holotype, 2 paratypes).
BIOCAL: stn CP 75, 22°19′ S, 167°23′ E, 825-860 m, 1 lv (paratype). — Stn DW 106, 21°36′ S, 166°29′ E, 625-650 m, 1 lv, 1 dd (paratypes).
West Indian Ocean. MD 32 Réunion: stn DS 149, 20°26′ S, 55°40′ E, 3500-3510 m, 1 dd.

FIG. 154. — Distribution of *Cadulus martini*.

DISTRIBUTION. — New Caledonia and Réunion Island, living in 625-860 m and shells (probably washed down) down to 3500 m.

DESCRIPTION. — *Shell* to 5 mm long, globose, shiny, white. Maximum diameter posterior to center of shell. Apical constriction shorter than oral. In lateral view, the ventral side shows a regular and pronounced curve to the neck. The dorsal side shows alternating concave and convex lines. The oral concave curve reaches maximum depth at 2/5 of the shell; the apical curve at the posterior 1/5. In frontal view, the posterior area from the maximum diameter is shorter and more curved than the anterior area which has straight sides tapering regularly to the mouth. Apex oval dorsoventrally,

Source : MNHN, Paris

with coronate structure. Preapical callus conspicuous, lumen oval dorsoventrally. Mouth laterally compressed, curved on ventral side, oblique.

Measurements: holotype L 5, W 1.9, m 1-0.8, apex 0.7-0.6; paratypes L 5.5, W 2-2, m 1-0.9, apex 0.7-0.6; L 5, W 2-1.9, m 1-0.8, apex 0.7-0.6; L 5.3, W 2-1.9, m 0.9-0.8, apex 0.7-0.6.

REMARKS. — A coronate structure of the apex is common among the globose *Cadulus*, and can be noticed in the apical part of the animal (SCARABINO, 1979).

ETYMOLOGY. — Named for the author's son Martin.

Cadulus glans sp. nov.

Figs 155, 160 g

TYPE MATERIAL. — Holotype and 7 paratypes MNHN.

TYPE LOCALITY. — New Caledonia, Loyalty Basin, BIOGEOCAL, stn KG 227, 21°33′ S, 166°24′ E, 500 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn KG 219, 22°39′ S, 166°34′ E, 570 m, 2 dd (paratypes). — Stn KG 227, 21°33′ S, 166°24′ E, 500 m, 1 dd (holotype). *"Vauban"* 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 5 dd (paratypes).

FIG. 155. — Distribution of *Cadulus glans*.

DISTRIBUTION. — Only known from New Caledonia, shells from 250-570 m.

DESCRIPTION. — *Shell* to 2 mm long, globose, glossy, translucent white. Equator posterior to the center of the shell. Apical constriction very short, formed by 11-12 lobes. In lateral view, the ventral side is straight to the center of the shell, then curves regularly and strongly to the apex; the dorsal side is sinusoidal, with the concave sector short near the mouth, with a long convex curve that reaches its maximum diameter at the posterior quarter. In frontal view the posterior area from the center is short and more curved than the anterior area, which has straight sides regularly tapering to the mouth. Apex oval laterally, larger than the mouth, with prominent coronate structure. Preapical callus prominent, lumen circular placed ventrally by the callus. Mouth circular, oblique.

Measurements: holotype L 1.7, W 0.89, m 0.44, apex 0.47.

Source : MNHN, Paris

REMARKS. — The coronate structure is formed by 11-12 wide lobes. The most similar species is *Cadulus martini*, from which *C. glans* differs in being the only species with the apex, rather than the lumen, larger than the mouth.

ETYMOLOGY. — From the latin *glans*: acorn-shaped.

Cadulus florenciae sp. nov.

Figs 156, 160 h

TYPE MATERIAL. — Holotype and 3 paratypes MNHN.

TYPE LOCALITY. — West Indian Ocean, MD 32 Réunion, stn DS 139, 20°47′ S, 55°38′ E, 1575-1600 m.

MATERIAL EXAMINED. — **West Indian Ocean**. MD 32 Réunion: stn DR 104, 20°49′ S, 55°01′ E, 1875-1920 m, 3 dd (paratypes). — Stn DS 139, 20°47′ S, 55°38′ E, 1575-1600 m, 1 lv (holotype).

FIG. 156. — Distribution of *Cadulus florenciae*.

DISTRIBUTION. — Only known from off Réunion Island, alive in 1575-1600 m.

DESCRIPTION. *Shell* to 2 mm long, delicate, fusiform, shiny, white, translucent. Maximum diameter at center of shell. The ventral side shows a regular curvature, less prominent in oral area; the dorsal side shows a slight swelling. Apex simple, oval dorsoventrally. Preapical callus conspicuous, lumen oval. Mouth suboval laterally compressed.

Measurements: holotype L 2, W 0.6, mouth 0.2, apex 0.2

REMARKS. — The most similar species is *Cadulus aequatorialis*, which differs in having a shorter oral area and neck.

ETYMOLOGY. — Named for the author's daughter, Florencia.

Source : MNHN, Paris

Cadulus sofiae sp. nov.

Figs 157, 160 i, l

TYPE MATERIAL. — Holotype MNHN. Paratypes: 7 MNHN, 1 NMP.

TYPE LOCALITY. — West Indian Ocean. MD 32 Réunion, stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn KG 03, 21°15′ S, 166°39′ E, 2340 m, 2 dd. — Stn KG 71, 22°10′ S, 167°33′ E, 2099 m, 1 dd. — Stn KG 102, 21°28′ S, 166°26′ E, 1810 m, 1 dd.
BIOGEOCAL: stn CP 243, 21°27′ S, 166°26′ E, 1820 m, 3 dd. — Stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 4 dd. — Stn KG 276, 21°13′ S, 167°00′ E, 2200 m, 1 dd. — Stn CP 317, 20°48′ S, 166°53′ E, 1620-1630 m, 2 dd.
CALSUB: dive 13, 21°26′ S, 166°23′ E, 1600 m, 3 dd.
West Indian Ocean. MD 32 Réunion: stn DS 149, 20°26′ S, 55°40′ E, 3500-3510 m, 1 lv (paratype NMP). — Stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m, 4 lv (holotype and 3 paratypes).
BENTHEDI: stn DS 11, 12°16′ S, 46°42′ E, 2300-2450 m, 1 dd (paratype). — Stn CH 87, 11°44′ S, 47°35′ E, 3716 m, 6 lv (2 paratypes). — Stn CH 90 11°44′ S, 47°30′ E, 3700 m, 1 dd (paratype).

FIG. 157. — Distribution of *Cadulus sofiae*.

DISTRIBUTION. — Réunion Island, NW Madagascar and New Caledonia, alive in 3500 to 3716 m, shells from 1600 m.

DESCRIPTION. — *Shell* to 5 mm, globose, white, shiny, translucent in fresh specimens. Maximum diameter at center of shell. In lateral view the swell is prominent on ventral side; in frontal view, both sides are similar. Rapidly tapering from the maximum diameter to apex and mouth. Circular in section. Apex simple, oval dorsoventrally. Preapical callus conspicuous, lumen circular. Mouth laterally compressed, oblique.

Mesurements: holotype L 4.5, w 2-2, d 2, m 1.9-1.7, arc 1.

REMARKS. — This species is similar in shape to *Cadulus tumidosus* Jeffreys, 1877, from the Atlantic Ocean, but less globose.

ETYMOLOGY. — Named for the author's daughter Sofia.

Source : MNHN, Paris

Cadulus labeyriei sp. nov.

Figs 158, 160 j

TYPE MATERIAL. — Holotype MNHN. Paratypes: 9 MNHN, 1 USNM.

TYPE LOCALITY. — Philippines, ESTASE 2, stn DW 1, 14°05′ N, 120°01′ E, 2200 m.

MATERIAL EXAMINED. — **Philippines**. ESTASE 2: stn DW 1, 14°05′ N, 120°01′ E, 2200 m, 3 lv (holotype and 2 paratypes). — Stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 8 lv (paratypes: 7 MNHN, 1 USNM).

FIG. 158. — Distribution of *Cadulus labeyriei*.

DISTRIBUTION. — Only known from the Philippines, living from 2050 to 2200 m.

DESCRIPTION. — *Shell* to 3 mm long, delicate, globose, shiny, white, translucent to transparent in fresh specimens. Maximum diameter near center of shell, oval in section, prominent. In lateral view, the ventral side shows regular curvature, while on the dorsal side the swelling is prominent and shows oral and apical constrictions. In front view, the maximum diameter is at the center of the shell, the constriction through mouth and the apex begins straight, near the apex the slight curvature forms a short neck. Apex simple, oval dorsoventrally. Preapical callus conspicuous, lumen circular. Mouth suboval laterally compressed, oblique.

Measurements: holotype L 2.7, W 1.2, m 0.4, apex 0.4; paratype L 3.1, W 1.3, m 0.4, apex 0.2.

REMARKS. — The most similar species is *Cadulus valdiviae*, which differs in its shorter apical and oral constrictions and is more swollen.

ETYMOLOGY. — Named for Dr Laurent LABEYRIE (CNRS, Gif), cruise leader of the ESTASE 2 Expedition aboard R.V. *"Jean-Charcot"*.

Other Indo-Pacific species of *Cadulus* cited in the literature

Cadulus campylus Melvill, 1906: 80, pl. 8, fig. 32. Gulf of Oman, 285 m. Syntype BMNH 1906.10.23.76, and 3 syntypes NMW (*fide* OLIVER, 1984) (not seen).

Source : MNHN, Paris

Cadulus euloides Melvill & Standen, 1901: 459, pl. 24, fig. 24. Gulf of Oman. Syntype BMNH 1901.12.9.12.
Cadulus ovalis Boissevain, 1906: 66, pl. 6, fig. 52. Madura Bay, Indonesia, *"Siboga"*, stn 51, 69-91 m. 2 syntypes dd ZMA.
Cadulus platei Jaeckel, 1932: 311, fig. 9. *"Valdivia"*, stn 109, off South Africa, 35°19′ S, 20°12′ E, 126 m. Holotype ZMB 75376.
Cadulus siberutensis Jaeckel, 1932: 309, fig. 7. Indonesia, Sumatra, *"Valdivia"*, stn 191, 00°39′ S, 98°52′ E, 750 m. Lectotype (KILIAS, 1995) ZMB 75368a.
Cadulus singaporensis Pilsbry & Sharp, 1898: 195, pl. 36, figs 30-32. Singapore. ANSP.
Cadulus valdiviae Jaeckel, 1932: 312, fig. 11. *"Valdivia"*, stn 251, off Somalia, 01°41′ S, 41°47′ E, 693 m. Lectotype (KILIAS, 1995) ZMB 75370a.

Genus *BATHYCADULUS* gen. nov.

Type species: *Bathycadulus fabrizioi* sp. nov.

DIAGNOSIS. — *Shell* medium sized for the family, smooth, shiny. Maximum diameter at the 3/5 median zone, where sides are almost parallel, or in two swellings, one at 2/5 and the other at 4/5 of the total length. Oral and apical constrictions pronounced, with short anterior and posterior areas. Apex simple or with a series of narrow notches forming a coronate edge. Section at apex slightly dorsoventrally compressed with a conspicuous preapical callus. Mouth oblique, laterally compressed. Apical area of animal short with principal muscular ring simple or coronate, neck with conspicuous dermic papillae.
Radula rachidian nearly as high as wide, anterior edge irregular, with a small cusp at the center and two or three denticles at each side. Lateral with well sculptured head, having three major cusps, one located internally, the other two externally, and 4-5 denticles; sculpture of the head of laterals accompanied by a chain of tooth like formations located at the outer side of primary cusps. Marginal slightly sigmoidally depressed, with the union edge to the lateral large and a prominent lateral keel.

REMARKS. — The subfamily Gadilinae includes the genera *Cadulus*, *Gadila* (radula very similar) and *Sulcogadila* Moroni & Ruggieri, 1981 (fossil from the Pleistocene of Sicily). *Cadulus* and *Sulcogadila* have the maximum diameter centrally located in one swelling with concave sides, and *Gadila* has the equator near the oral aperture, and usually concave dorsal and ventral sides. *Bathycadulus* has unique shell characters for the class, with sides almost parallel and even slightly concave at the maximum diameter.

Two additional new species of this genus, from bathyal and abyssal depths of the Atlantic Ocean, will be described elsewhere.

DISTRIBUTION. — Recent, Indian and Atlantic Oceans, abyssal.

Bathycadulus fabrizioi sp. nov.

Figs 159, 160 m-n

TYPE MATERIAL. — Holotype SAM A36258. Paratypes: 1 SAM A36259, 1 USNM, 11 MNHN, 1 NMP, 1 Museo Nacional de Historia Natural, Montevideo, Uruguay 14751.

TYPE LOCALITY. — South Africa, *"Meiring Naudé"*, stn SM 109, 28°41′ S, 32°37′ E, 1300 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn KG 221, 22°42′ S, 166°24′ E, 1915 m, 1 dd. — Stn KG 222, 22°45′ S, 166°25′ E, 1675 m, 1 dd.

Source : MNHN, Paris

West Indian Ocean. MD 32 Réunion: stn DS 78, 21°13′ S, 55°04′ E, 1175-1200 m, 1 lv, 1 dd. — Stn DS 106, 20°48′ S, 55°05′ E, 1710-1730 m, 1 lv. — Stn DS 109, 20°52′ S, 55°06′ E, 1050-1240 m, 12 lv (paratypes: 11 MNHN, 1 USNM), 1 dd (paratype NMP). — Stn DS 139, 20°47′ S, 55°38′ E, 1575-1600 m, 8 lv, 2 dd.
"Meiring Naudé": stn SM 109, 28°41′ S, 32°37′ E, 1300 m, 2 lv (holotype and 1 paratype SAM), 1 dd (paratype Montevideo).

FIG. 159. — Distribution of *Bathycadulus fabrizioi*.

DISTRIBUTION. — Southeast Africa, Réunion Island and New Caledonia, alive in 1200-1600 m, shells down to 1915 m.

DESCRIPTION. — *Shell* to 7 mm long, shiny, translucent to porcellaneous white. Maximum diameter at 3/5 of shell length, sides parallel. Neck and mouth with a short constriction. Apex simple with irregular coronate edge; slightly dorsoventrally compressed in section, with a prominent preapical callus. Oral aperture simple, laterally compressed.
Radula as for the genus.
Measurements: holotype L 5.2, W 1.05, w 0.8, apex 0.8, arc (at the equator) 0.1.

ETYMOLOGY. — Named for the author's son Fabrizio.

Genus *GADILA* Gray, 1847

Type species (OD): *Dentalium gadus* Montagu, 1803. Recent, type locality unknown.

Synonym: *Platyschides* Henderson, 1920. Type species (OD): *Cadulus grandis* Verrill, 1885. Recent, NW Atlantic Ocean, 906 fms [1703 m].

DIAGNOSIS. — *Shell* small to medium, curved, smooth, white, translucent when fresh, shiny when dead. Maximum diameter in anterior third of the shell; ventral side regularly curved, dorsal side sigmoidal in section. Apex simple or with flat lobes, variable in number. Oral and apical section different.
Radula similar to that of *Cadulus* (Fig. 169 h, *Gadila* sp.).

DISTRIBUTION. — Cretaceous-Recent, worldwide, littoral-abyssal.

Source : MNHN, Paris

Gadila virginalis (Boissevain, 1906)

Figs 161, 169 a

Cadulus virginalis Boissevain, 1906: 72, pl. 6, figs 60-64.

Other references:
Cadulus (Platyschides) virginalis – Habe & Kosuge, 1964: 12.
Platyschides virginalis – Habe, 1963: 279, textfigs 40-43; 1964a: 40, pl. 5, figs 40-42.
Polyschides (Platyschides) virginalis – Habe, 1977: 342, pl. 71, figs 22-24. — Higo & Goto, 1993: 690.

Type material. — Lectotype (here designated) ZMA 3.06.096, paralectotypes ZMA 3.06.097-100.

Type locality. — *C. virginalis*: Indonesia, Savu Sea, "*Siboga*", stn 52, 09°03′ S, 119°57′ E, 959 m.

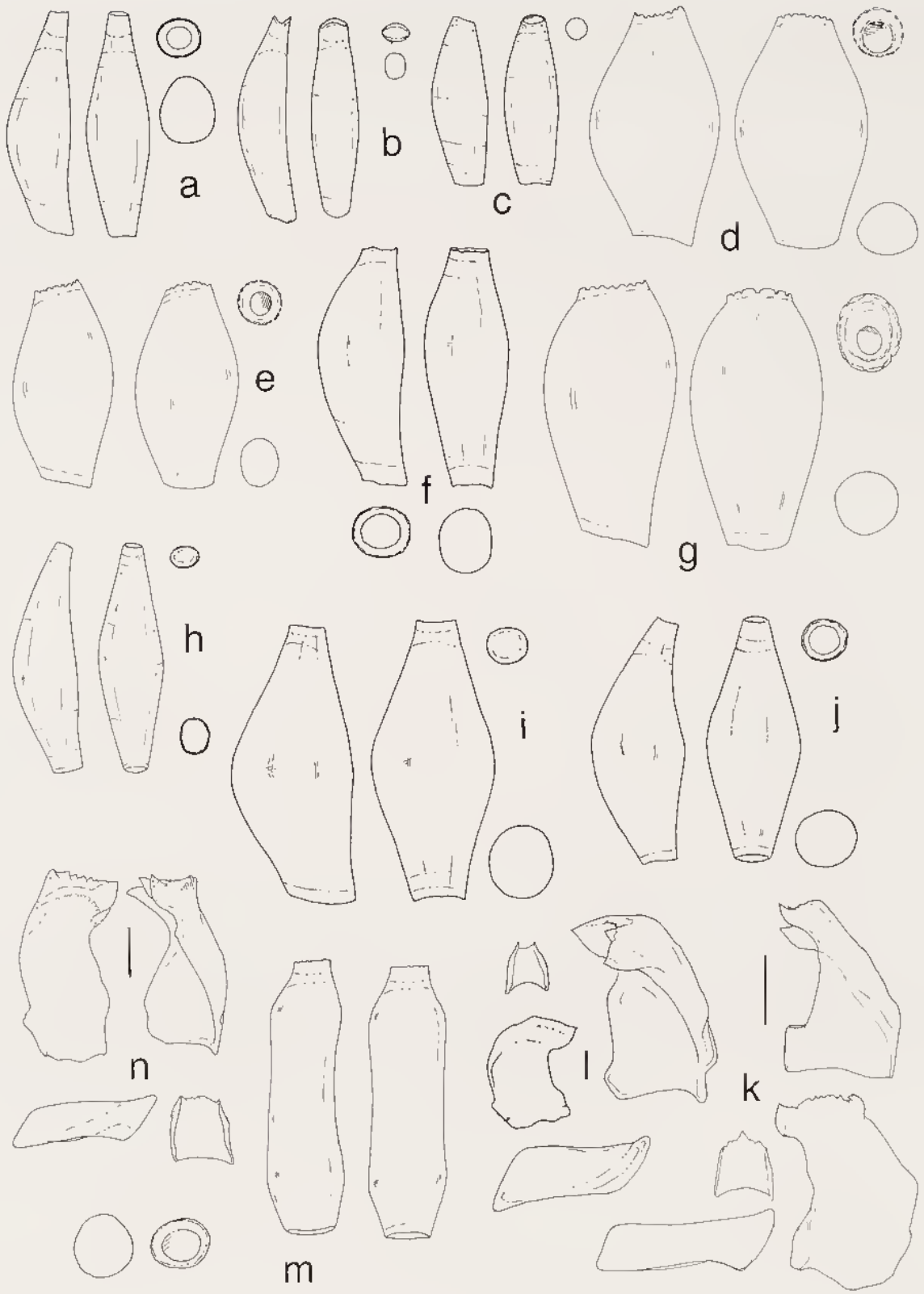
Material examined. — The type material.
New Caledonia. BIOCAL: stn DW 49, 23°03′ S, 167°33′ E, 825-830 m, 1 dd.
Indonesia. CORINDON: stn B 236, 00°07′ S, 119°45' E, 1730 m, 2 dd.
Philippines. MUSORSTOM 3: stn DR 93, 13°49' N, 120°02′ E, 540 m, 1 dd.

Fig. 161. — Distribution of *Gadila virginalis*.

Distribution. — Southern Japan (?) to Indonesia, now extended to New Caledonia. Shells in 200-3010 m (Habe & Kosuge, 1964).

Fig. 160. — **a**, *Cadulus simillimus*, shell (3 mm), lateral and dorsal views, apical and oral sections, BIOGEOCAL: stn KG 219. — **b**, *Cadulus aratus*, shell (2 mm), apical and oral sections, MUSORSTOM 2: stn DR 33. — **c**, *Cadulus aequatorialis*, shell (4 mm), apical and oral sections, BIOGEOCAL: stn CP 214. — **d**, *Cadulus cyathoides*, shell (2.5 mm), lateral and dorsal views, apical and oral sections, ESTASE 2: stn CP 2. **e**, *Cadulus cluni*, shell (2.5 mm), apical and oral sections, MUSORSTOM 3: stn CP 143. — **f**, *Cadulus martini* sp. nov., holotype, shell (5 mm), apical and oral sections. — **g**, *Cadulus glaus* sp. nov., holotype, shell (1.7 mm), lateral and dorsal views, apical and oral sections. — **h**, *Cadulus florenciae* sp. nov., holotype, shell (2 mm), lateral and dorsal views, apical and oral sections. — **i**, *Cadulus sofiae* sp. nov., holotype, shell (4.5 mm), lateral and dorsal views, apical and oral sections. — **j**, *Cadulus labeyirei* sp. nov., holotype, shell (2.7 mm), lateral and dorsal views, apical and oral sections. — **k-l**, *Cadulus* type radula. — **k**, *C. tumidosus* Jeffreys, 1877 (North Atlantic Ocean). — **l**, *C. sofiae*. — **m**, *Bathycadulus fabrizioi* sp. nov., holotype, shell (5.2 mm), apical and oral sections. — **n**, *Bathycadulus* type radula (*B. fabrizioi*).

Source : MNHN, Paris



Source : MNHN, Paris

REMARKS. — HABE (1963, 1964b, 1977) includes *Gadila novilunata* Kira, 1959 in the synonymy of *virginalis*, but I prefer to keep them separate pending further study. Consequently, it is uncertain whether the records of *Cadulus virginalis* from Japan refer to the present species or to *G. novilunata*.

Gadila zonata (Boissevain, 1906)

Figs 162, 169 b

Cadulus zonatus Boissevain, 1906: 74, pl. 6, fig. 57, textfig. 37.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.102, paralectotypes ZMA 3.06.103.

TYPE LOCALITY. — Indonesia, Banda Sea, *"Siboga"*, stn 214, 06°30′ S, 121°55′ E, 2796 m.

MATERIAL EXAMINED. — The type material.
Philippines. MUSORSTOM 2: stn CP 18, 14°00′ N, 120°18′ E, 188-195 m, 1 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 1 dd.

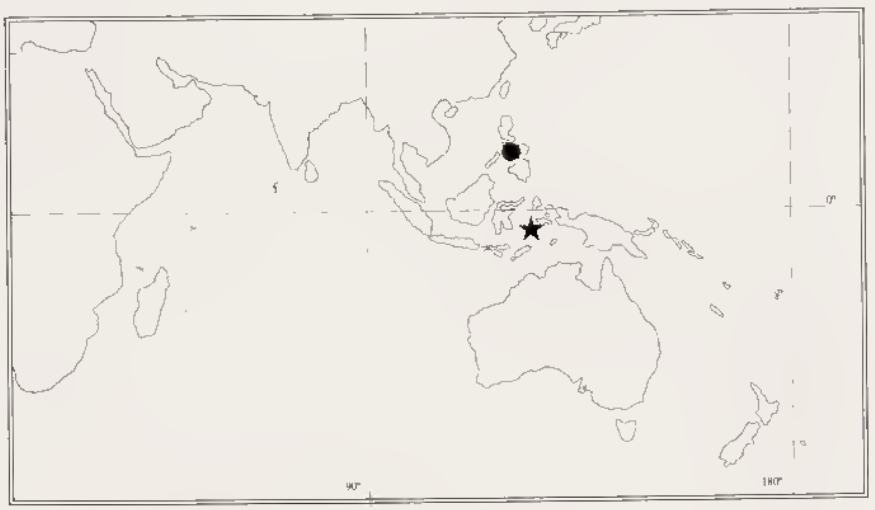


FIG. 162. — Distribution of *Gadila zonata*.

DISTRIBUTION. — Indonesia and the Philippines, shells from 195 to 2796 m, no record of living specimens.

Gadila boissevainae (Jaeckel, 1932)

Figs 163, 169 c

Cadulus boissevaini Jaeckel, 1932: 311, textfig. 8.

Synonym:
Cadulus (Gadila) reesi Ludbrook, 1954: 115, fig. 20 (**Syn. nov.**).

Other reference:
Cadulus (Cadulus) boissevaini — HABE & KOSUGE, 1964: 9.

Source : MNHN, Paris

TYPE MATERIAL. — *C. boissevaini*: lectotype, designated by KILIAS (1995), ZMB 75359a. — *C. reesi*: holotype BMNH 1952.3.25.150.

TYPE LOCALITY. — *C. bossevaini*: East Africa. off Zanzibar, *"Valdivia"*, stn 251, 01°41′ S, 41°47′ E, 693 m. — *C. reesi*: Zanzibar area, *"John Murray"*, stn 105B, 05°34′ S, 39°14′ E, 238-293 m.

MATERIAL EXAMINED. — The type material of *C. reesi*.
Northwest Indian Ocean. Gulf of Aden, *"John Murray"*: stn 176, 12°04′ N, 50°38′ E, 655-732 m, 3 dd. — Stn 179b, 12°02′ N, 50°40′ E, 275 m, 1 dd. — Stn 191, 13°46′ N, 47°49′ E, 274 m, 7 dd (all BMNH)
West Indian Ocean. *"Meiring Naudé"*: stn SM 53, 26°51′ S, 33°13′ E, 720 m, 1 lv, 5 dd. — Stn 59. 27°10′ S, 32°59′ E, 820 m, 8 lv, 35 dd (1 lv, 1 dd MNHN). — Stn SM 69, 27°14′ S, 33°12′ E 680-700 m, 1 lv, 1 dd. — Stn SM 78, 27°32′ S, 32°50′ E, 750 m, 9 lv, 26 dd. — Stn SM 94, 28°50′ S, 32°50′ E, 750 m, 3 dd. — Stn SM 125, 30°32′ S, 30°57′ E, 1280 m, 1 lv, 6 dd. — Stn 162, 32°55′ S, 28°31′ E, 630 m, 1 dd.

FIG. 163. — Distribution of *Cadulus boissevainae*.

DISTRIBUTION. — Western Indian Ocean from the Gulf of Aden to Natal, alive in 680-1280 m, shells up to 274 m.

REMARKS. — Because Maria Boissevain was a woman, the specific name is here emended to *boissevainae* (ICZN, Art. 31(a)(i)). The specimens of *Cadulus reesi* are all fragments, without the neck area. The rest of the shell corresponds to *Gadila boissevainae* and leads me to consider it a junior synonym of Jaeckel's species.

Gadila elenae sp. nov.

Figs 164, 169 d

TYPE MATERIAL. — Holotype MNHN. Paratypes: 7 MNHN, 1 AMS C201733, 1 NMNZ M268956.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 156, 18°54′ S, 163°19′ E, 525 m.

Source : MNHN, Paris

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 08, 20°34′ S, 166°54′ E, 435 m, 2 dd (paratypes).
MUSORSTOM 4: stn DW 156, 18°54′ S, 163°19′ E, 525 m, 1 lv (holotype), 2 dd (paratypes). — Stn DW 160, 18°42′ S, 163°13′ E, 668 m, 1 lv, 2 dd (paratypes: 1 MNHN, 1 AMS, 1 NMNZ).
Loyalty Islands. MUSORSTOM 6: stn DW 410, 20°38′ S, 167°07′ E, 490 m, 2 dd (paratypes).

FIG. 164. — Distribution of *Gadila elenae*.

DISTRIBUTION. — New Caledonia, living from 525 to 668 m, shells from 435 m.

DESCRIPTION. — *Shell* to 12 mm long, smooth, shiny, translucent white. Ventral side showing a regular curve, dorsal side sinusoidal with convex curve at first quarter and concave curve rising to the apex. Maximum diameter near the anterior quarter of the shell, suboval in section. Apex oval, dorsoventrally depressed with ventral and dorsal lobes, the former larger and with a central denticle-like structure. Preapical callus prominent, lumen circular. Mouth oblique, subcircular in section.

Measurements: holotype L 11.5, W 2.5-2.3, m 1.35-1.20, apex 1-1.8; paratype L 10.1, W 2.3-2.1, m 1.3-1.2, apex 0.9-0.85; L 8.5, W 2.3-2.2, m 1.6-1.4, apex 1.50-1.51.

REMARKS. — The apical structure is similar to that of *Gadila monodonta*, described below, which is larger and fusiform.

ETYMOLOGY. — Named for Elena GOFAS-SALAS (Paris, Malaga).

Gadila doumenci sp. nov.

Figs 165, 169 e

TYPE MATERIAL. — Holotype and 3 paratypes MNHN.

TYPE LOCALITY. — West Indian Ocean, BENTHEDI, stn DS 11, 12°16′ S, 46°42′ E, 2300-2450 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn CP 260, 21°00′ S, 166°58′ E, 1820-1960 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DS 03, 12°36′ S, 47°38′ E, 1100-1150, 1 lv (paratype). — Stn DS 11, 12°16′ S, 46°42′ E, 2300-2450 m, 1 lv (holotype). — Stn DR 40, 12°56′ S, 45°18′ E, 1300-1480 m, 1 lv, 1 dd (paratypes).

Source : MNHN, Paris

FIG. 165. — Distribution of *Gadila doumenci*.

DISTRIBUTION. — New Caledonia and NW Madagascar, living from 1100 to 2450 m.

DESCRIPTION. — *Shell* to 11 mm long, solid, shiny, moderately curved, white. Maximum diameter at anterior fifth of the shell. Apex almost as wide as mouth, simple. Preapical callus wide, lumen circular. Mouth slightly laterally compressed with the ventral side flattened, straight, simple.

Measurements: holotype L 10.5, W 2.2-2.15, m 1.6-1.5, w 1.1-1.06; paratypes L 9.4, W 2.05, m 1.4, w 1; L 9, W 2, m 1.2, w 0.9.

ETYMOLOGY. — Named for Prof. Dominique DOUMENC, who made possible my work as visiting curator in MNHN.

Gadila desaintlaurentae sp. nov.

Figs 166, 169 f

TYPE MATERIAL. — Holotype MNHN. Paratypes: 8 MNHN, 1 AMS C201734, 1 USNM.

TYPE LOCALITY. — Philippines, MUSORSTOM 2, stn DR 33, 13°32′ N, 121°08′ E, 130-137 m.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 1 lv, 12 dd.
Indonesia. CORINDON: stn B 268, 01°57′ S, 119°16′ E, 200 m, 2 dd.
Philippines. MUSORSTOM 2: stn DR 33, 13°32′ N, 121°08′ E, 130-137 m, 3 lv (holotype and paratypes), 15 dd (paratypes: 6 MNHN, 1 AMS, 1 USNM).
MUSORSTOM 3: stn CP 112, 14°00′ N, 120°18′ E, 187-199 m, 1 dd.

DISTRIBUTION. — The Philippines, Indonesia and New Caledonia, living from 137 to 250 m.

DESCRIPTION. — *Shell* to 6 mm long, shiny, white, with maximum diameter at anterior third. Ventral side regularly curved, dorsal side describing a convexity followed by a pronounced concavity that reaches the apex. Apex simple, circular. Preapical callus faint, lumen circular. Mouth simple, oblique, circular.

Measurements: holotype L 6, W 1.1, m 0.7, w 0.4; paratypes L 5.8, W 1.2, m 0.7, w 0.4; L 5.5, W 1.1, m 0.7, w 0.4; L 6.3, W 1.2, m 0.8, w 0.4; L 5.6, W 1, m 0.7, w 0.4.

Source : MNHN, Paris

FIG. 166. — Distribution of *Gadila desaintlaurentae*.

ETYMOLOGY. — Named for Dr Michèle DE SAINT-LAURENT, formerly curator of Crustacea (MNHN), who participated in the first three MUSORSTOM expeditions to the Philippines.

Gadila minutalis sp. nov.

Figs 167, 169 g

TYPE MATERIAL. — Holotype and 8 paratypes lv, MNHN.

TYPE LOCALITY. — West Indian Ocean, MD32 Réunion, stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m.

MATERIAL EXAMINED. — Only known from the type material.

FIG. 167. — Distribution of *Gadila minutalis*.

Source : MNHN, Paris

DISTRIBUTION. — Only known from Réunion Island, alive in 3240-3300 m.

DESCRIPTION. — *Shell* to 3 mm long, fragile, shiny, white, moderately curved. Maximum diameter at anterior quarter of the shell. Apex simple, circular. Preapical callus thin, lumen circular. Mouth simple, straight, circular.

Measurements: holotype L 2.9, W 0.5, m 0.3, w 0.2.

ETYMOLOGY. — Very small (Latin).

Gadila monodonta sp. nov.

Figs 168, 169 i

TYPE MATERIAL. — Holotype and 2 paratypes MNHN.

TYPE LOCALITY. — West Indian Ocean, BENTHEDI, stn DS 10, 11°29′ S, 47°18′ E, 440 m.

MATERIAL EXAMINED. — **New Caledonia**. CALSUB: dive 20, 22°53′ S, 167°23′ E, 580 m, 1 dd. **West Indian Ocean**. BENTHEDI: stn DS 10, 11°29′ S, 47°18′ E, 440 m, 1 lv (holotype). — Stn DS 120, 11°30′ S, 47°25′ E, 335-390 m, 1 lv (paratype). — Stn DS 122, 11°32′ S, 47°23′ E, 615-625 m, 1 dd (paratype).

FIG. 168. — Distribution of *Gadila monodonta*.

DISTRIBUTION. — NW Madagascar and New Caledonia, alive in 390-440 m, shells down to 625 m.

DESCRIPTION. — *Shell* to 15 mm long, shiny, white, maximum diameter near the center of the shell, giving a generally fusiform shape. Ventral side regularly curved; curve of dorsal side interrupted at the maximum diameter. Apex oval, with ventral lobe showing a central denticle at the edge. Preapical callus thin, lumen suboval. Mouth simple, oblique, slightly dorsoventrally compressed.

Measurements: holotype L 14.2, W 2.6-2.45, m 1.45-1.25, w 0.75-0.7.

REMARKS. — The fusiform shape and distinctive apical feature easily characterize this new species.

ETYMOLOGY. — From the Latin, meaning a single tooth.

Source : MNHN, Paris

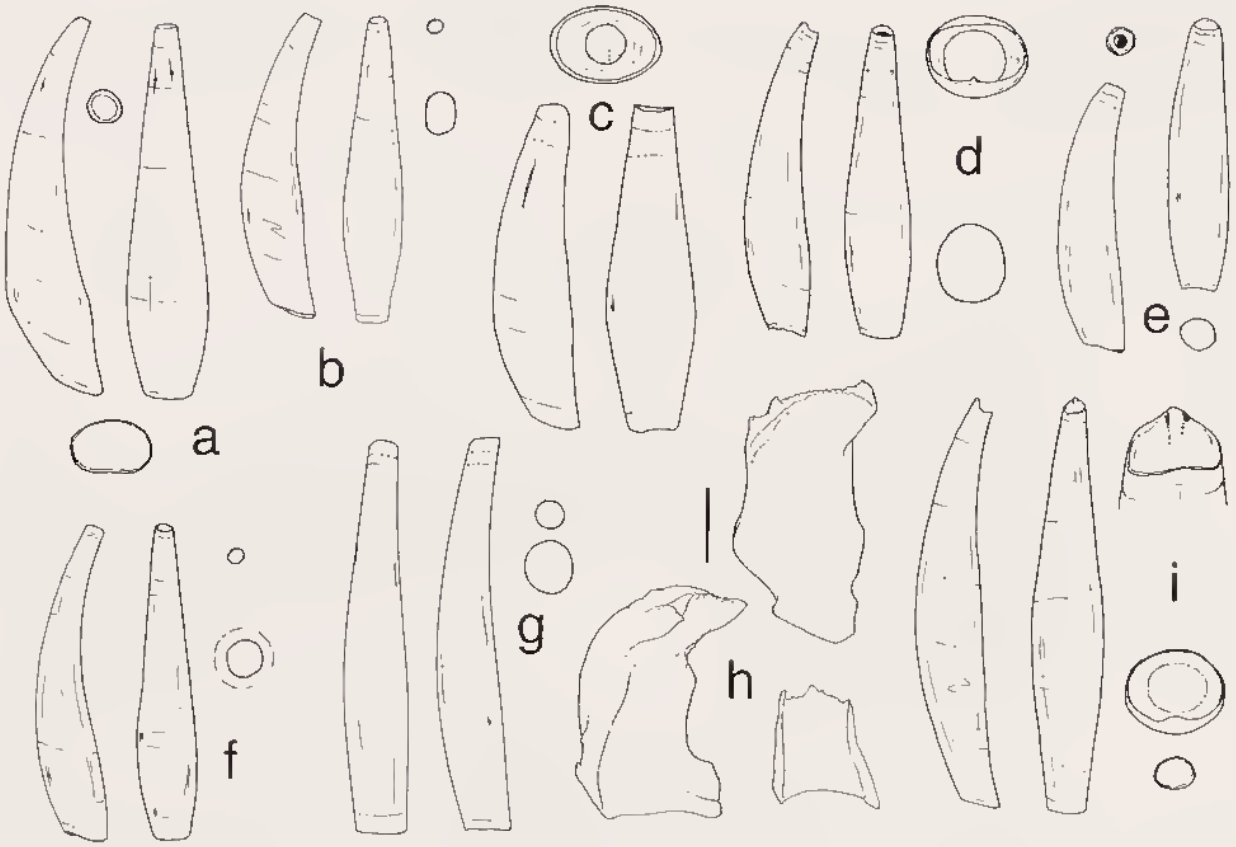


FIG. 169. — **a**, *Gadila virginalis*, shell (16 mm), lateral and dorsal views, apical and oral sections, CORINDON: stn B 236. — **b**, *Gadila zonata*, shell (14 mm), lateral and dorsal views, apical and oral sections, MUSORSTOM 2: stn CP 18. — **c**, *Gadila boissevainae*, shell (7.5 mm), lateral and dorsal views, apical section, *"Meiring Naudé"*, stn SM 59. — **d**, *Gadila elenae* sp. nov., holotype, shell (11.5 mm), lateral and dorsal views, apical and oral sections. — **e**, *Gadila doumenci* sp. nov., holotype, shell (10.5 mm), lateral and dorsal views, apical and oral sections. — **f**, *Gadila desaintlaurentae* sp. nov., holotype, shell (6 mm), lateral and dorsal views, apical and oral sections. — **g**, *Gadila minutalis* sp. nov., holotype, shell (2.9 mm), dorsal and lateral views, apical and oral sections. — **h**, *Gadila* type radula (*Gadila* sp. nov., Caribbean Sea). — **i**, *Gadila monodonta* sp. nov., holotype, shell (14.2 mm), lateral and dorsal views, apex, apical and oral sections.

Other Indo-Pacific species of *Gadila* cited in the literature

Gadila abruptoinflata Boissevain, 1906: 75, pl. 66, fig. 65, textfig. 39. Indonesia, Madura, *"Siboga"*, stn 5, 07°46 'S, 114°31' E, 330 m. Holotype ZMA.

Gadila anguidens (Melvill & Standen, 1898): 32, pl. 1, fig. 6. Off Madras, India. Holotype and paratype, Manchester Museum (*fide* TREW, 1987).

Gadila clavata (Gould, 1859): 166. Hong Kong, China, 11-36 m. Holotype USNM 24245.

Gadila honoluluensis (Watson, 1879): 89. *"Challenger"*, Reefs of Honolulu, Hawaii, 40 fms [73 m]. Holotype BMNH 1887.2.9.70.

Gadila opportuna (Kuroda & Habe, 1961): 105, pl. 47, fig. 2. Sagami Bay, Japan, 200 m. NSMT.

Gadila pseudolivae (Boissevain, 1906): 73, pl. 6, fig. 67, textfig. 36. *"Siboga"*, stn 211, 05°41' S, 120°46' E, Banda Sea, 1158 m. Syntype ZMA.

Gadila subcolubridens Ludbrook, 1954: 115, fig. 21. Gulf of Aden, *"John Murray"*, stn 185, 13°48' N, 49°16' E, 2000 m. Presumably in BMNH (not located).

Gadila subtilis (Plate, 1908a): 360, pl. 30, fig. 48. Off Dar-es-Salaam, Tanzania, *"Valdivia"*, stn 244, 05°56' S, 39°01' E, 50 m. Lectotype (KILIAS, 1995) ZMB 61108a.

Gadila novilunata Kira, 1955: 80, pl. 40, fig. 2. Japan, Shikoku.

Source : MNHN, Paris

Family *incertae sedis*

The following two genera possess confusing characters that do not allow placement in the present classification. *Megaentalina* is the only representative of the Order having a triangular section and a *Siphonodentalium* type radula. *Compressidens* has dorsoventrally compressed and curved shell as a diagnostic character in all species. Pending further data, I have decided to treat both genera separate from the rest.

Genus *Megaentalina* Habe, 1963

Type species (OD): *M. teramachii* Kuroda & Habe *in* Habe, 1963 [= *M. mediocarinata* Boissevain, 1906].

Diagnosis. — *Shell* medium to large, well arched, solid, polished, white to cream. Sculpture of 3 primary ribs, with one angle on dorsal side and a base at the ventral; secondary riblets present; rib section flat-topped to rounded; smooth; intercostal spaces, almost straight. Apex simple or with two flat notches, one dorsal and the other ventral. Section subtriangular at apex, less noticeable at mouth.

Radula rachidian polygonal with wide base, anterior border irregular, with 5-6 prominent nodules in the interior face that overpass the border; laterals similar to *Siphonodentalium*, strong, curved, with short but strong cusps; marginals straight with internal side wider than the external side.

Distribution. — Recent, East Pacific and Indian Oceans, absent in the Atlantic Ocean. Shelf-bathyal.

Remarks. — Steiner (1991) places *Megaentalina* in the Order Dentaliida, on my advice (Scarabino, 1986, pers. com.). This suggestion was incorrect, since it was based on the radula of two animals supposedly conspecific with two shells of *Megaentalina mediocarinata* found in the same vial. Recent study of live animals has corrected this error — the earlier specimens belong to a dentaliid species. My erroneous placement can now be corrected and we await further data for proper classification of this genus.

Fig. 170. — Distribution of *Megaentalina cornucopiae*.

Source : MNHN, Paris

Megaentalina cornucopiae (Boissevain, 1906)

Figs 170, 174 b

Entalina cornucopiae Boissevain, 1906: 63, pl. 6, fig. 89.

Other references:

Megaentalina cornucopiae – Habe, 1963: 272, pl. 38, figs 31-32; 1964a: 41, pl. 2, figs 31-32; 1977: 340. — Habe & Kosuge, 1964: 9. — Chistikov, 1982c: 1499, pl. 2, figs 4-6. — Higo & Goto, 1993: 689.

Type material. — Holotype ZMA 3.06.086.

Type locality. — Indonesia, Sumba Sea, "*Siboga*", stn 52, 09°03′ S, 119°57′ E, 959 m.

Material examined. — The type material.
Philippines. ESTASE 2: stn DR 4, 05°02′ N, 125°15′ E, 3250 m, 1 dd.

Distribution. — Japan, the Philippines, Indonesia, shells from 959 to 3250 m.

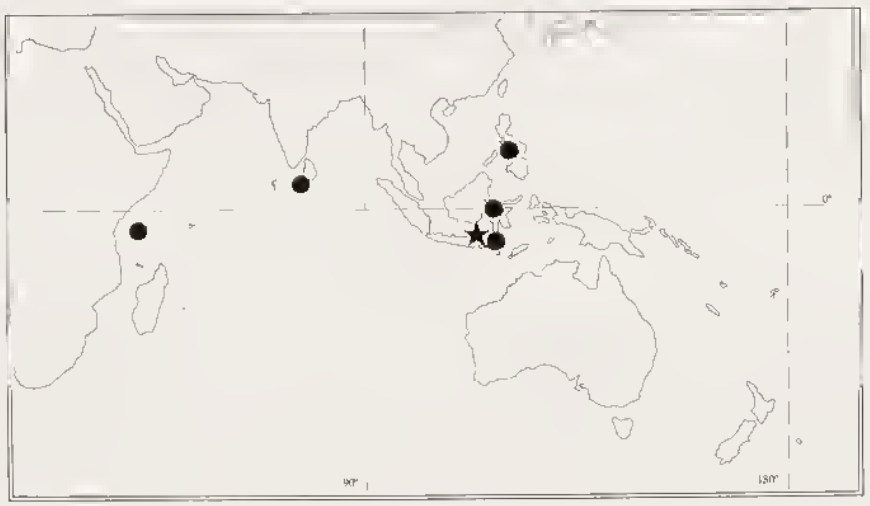


Fig. 171. — Distribution of *Megaentalina mediocarinata*.

Megaentalina mediocarinata (Boissevain, 1906)

Figs 171, 172 e-f, 174 a, c

Entalina mediocarinata Boissevain, 1906: 63, pl. 6, figs 70-72, 87-88.

Synonym:

Megaentalina teramachii Kuroda & Habe *in* Habe, 1963: 273, pl. 38, figs 12-13.

Other references:

Megaentalina mediocarinata – Habe, 1964a: 42, pl. 2, figs 12-13; 1977: 340. — Habe & Kosuge, 1964: 9. — Chistikov, 1982c: 1498. — Higo & Goto, 1993: 689.
Dentalium (*Compressidens*) *comprimatum* – Ludbrook, 1954: 106.

Type material. — *E. mediocarinata*: lectotype (here designated) ZMA 3.06.084, paralectotypes ZMA 3.06.085. — *M. teramachii*: holotype, NSMT.

Type locality. — *E. mediocarinata*: Bali Sea, Indonesia, "*Siboga*", stn 5, 07°46′ S, 114°30′ E, 330 m. — *M. teramachii*: Tosa Bay, Shikoku, Japan, 200 m.

Source : MNHN, Paris

MATERIAL EXAMINED. — The type material of *E. mediocarinata*.
Indonesia. CORINDON: stn B 213, 00°31′ N, 117°50′ E, 488 m, 1 dd.
"Snellius" II: stn 4.130, 08°18′ S, 118°18′ S, 700-730 m, 2 lv, 3 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 680-800 m, 1 dd (RMNH).
Philippines. MUSORSTOM 2: stn CP 24, 13°37′ N, 120°42′ E, 640-647 m, 1 dd. — Stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 4 lv, 11 dd. — Stn CP 26, 13°49′ N, 120°50′ E, 299-330 m, 3 dd. — Stn CP 40, 13°08′ N, 122°40′E, 280-440 m, 1 dd. — Stn CP 46, 13°26′ N, 122°17′ E, 445-520 m, 1 lv. — Stn CP 78, 13°49′ N, 120°28′ E, 441-550 m, 3 lv, 3 dd.
MUSORSTOM 3: stn CP 123, 12°10′ N, 121°45′ E, 700-702 m, 1 dd. — Stn CP 128, 11°50′ N, 121°42′ E, 815-821 m, 1 dd.
West Indian Ocean. Zanzibar area, *"John Murray"*: st 105B, 05°24′ S, 39°14′ E, 238-293 m, 1 dd [*Dentalium* (*Compressidens*) *comprimatum*] (BMNH).
Northern Indian Ocean. SAFARI 2: stn CP 06, 08°11′ N, 79°03′ E, 1035 m, 1 lv.

DISTRIBUTION. — Japan, the Philippines, now extended to Indonesia and off Sri Lanka and Zanzibar, living depth range 441-1035 m, shells from 300 m.

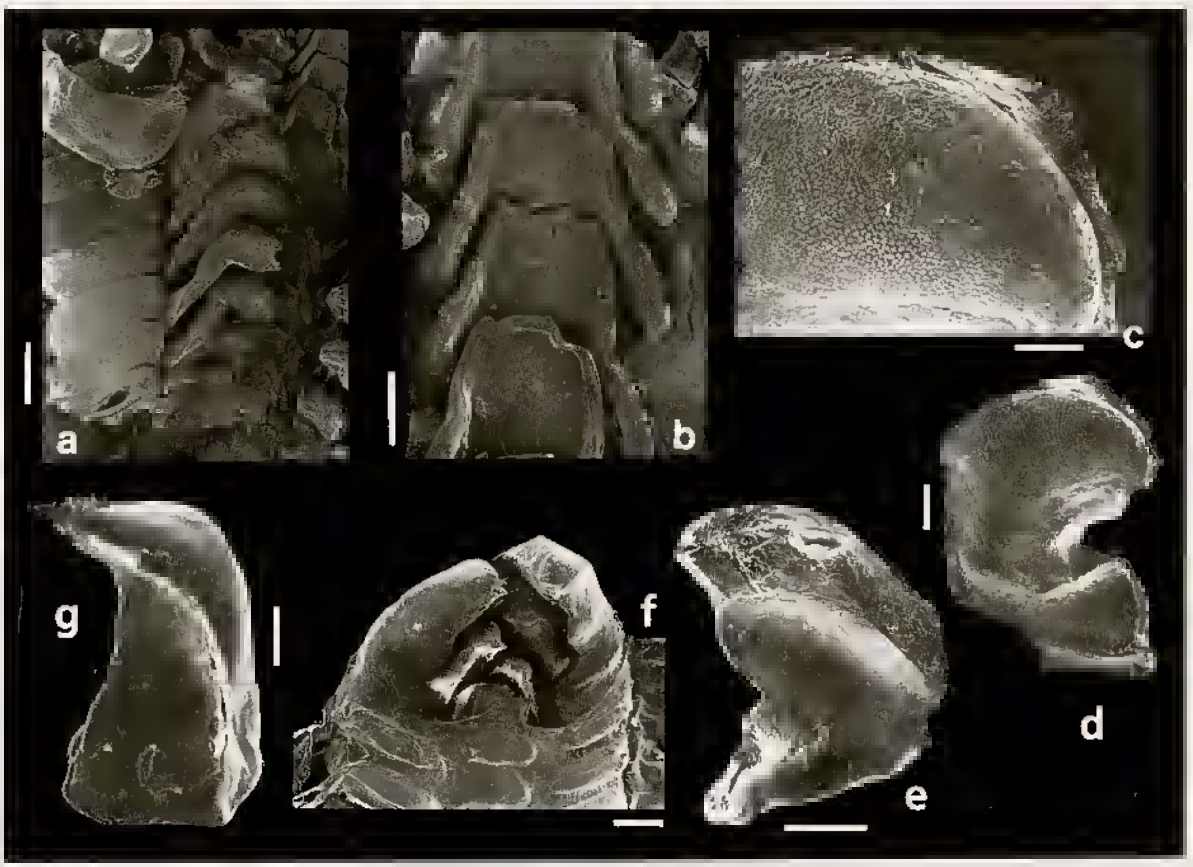


FIG. 172. — Radulae. — **a**, *Spadentalina tubiformis*, general view, note at upper left an internal face view of a lateral teeth, to be compared with *Entalinopsis* and *Pertusiconcha* radulae (Figs 115 d and g respectively). — **b**, same specimen, rachidians. — **c**, *Striocadulus sagei*, margin of the head of a lateral tooth. — **d**, same specimen, general view. — **e**, *Megaentalina mediocarinata*, internal face of lateral tooth. — **f**, *Megaentalina mediocarinata*, external view of lateral and rachidians. — **g**, *Solenoxiphus striatulus*, internal view of lateral tooth. Scale lines: 100 µm (a, d-f), 10 µm (b, c), 20 µm (f).

Source : MNHN, Paris

Genus *Compressidens* Pilsbry & Sharp, 1897

Type species (OD): *Dentalium pressum* Pilsbry & Sharp, 1897. Recent, North of Culebra Island, West Indies, 390 fms [714 m].

Diagnosis. — *Shell* small to medium, well curved, solid, translucent, opaque or polished. Section oval, strongly compressed dorsoventrally. Sculpture variable, with longitudinal riblets, undulations or fine, close encircling wrinkles; growth lines conspicuous. Apex simple or truncate, preapical callus usually wide, lumen circular.
Radula rachidian high, with cusped anterior marging; lateral high, with very sharp-pointed cusps; marginal short, sinusoidal (Fig. 174 e, *C. ophiodon* Dall, 1881).

Distribution. — Miocene-Recent, worldwide, shelf-bathyal.

Compressidens infimus sp. nov.

Figs 173, 174 d

Type material. — Holotype and 8 paratypes lv, MNHN.

Type locality. — West Indian Ocean, MD 32 Réunion, stn DS 109, 20°52′ S, 55°06′ E, 1050-1240 m.

Material examined. — Only known from the type material.

Fig. 173. — Distribution of *Compressidens infimus*.

Distribution. — Réunion Island, alive in 1050-1240 m.

Description. — *Shell* to 5 mm long, fragile, well curved. Sculture of close, fine, encircling wrinkles throughout. Apex subcircular, dorsoventally depressed. Preapical callus thin, lumen circular. Mouth thin, slighily dorsoventrally depressed, especially on ventral side.
Measurements: holotype L 4, W 0.5·0.45, w 0.1, arc 0.22.

Source : MNHN, Paris

REMARKS. — Compared with *Compressidens platyceras*, a shallow water species from Eastern Australia, *C. infimus* is smaller and less compressed. *C. comprimatum* (Plate, 1908a) from Zanzibar Channel, has longitudinal striation.

ETYMOLOGY. — From the Latin meaning very little.

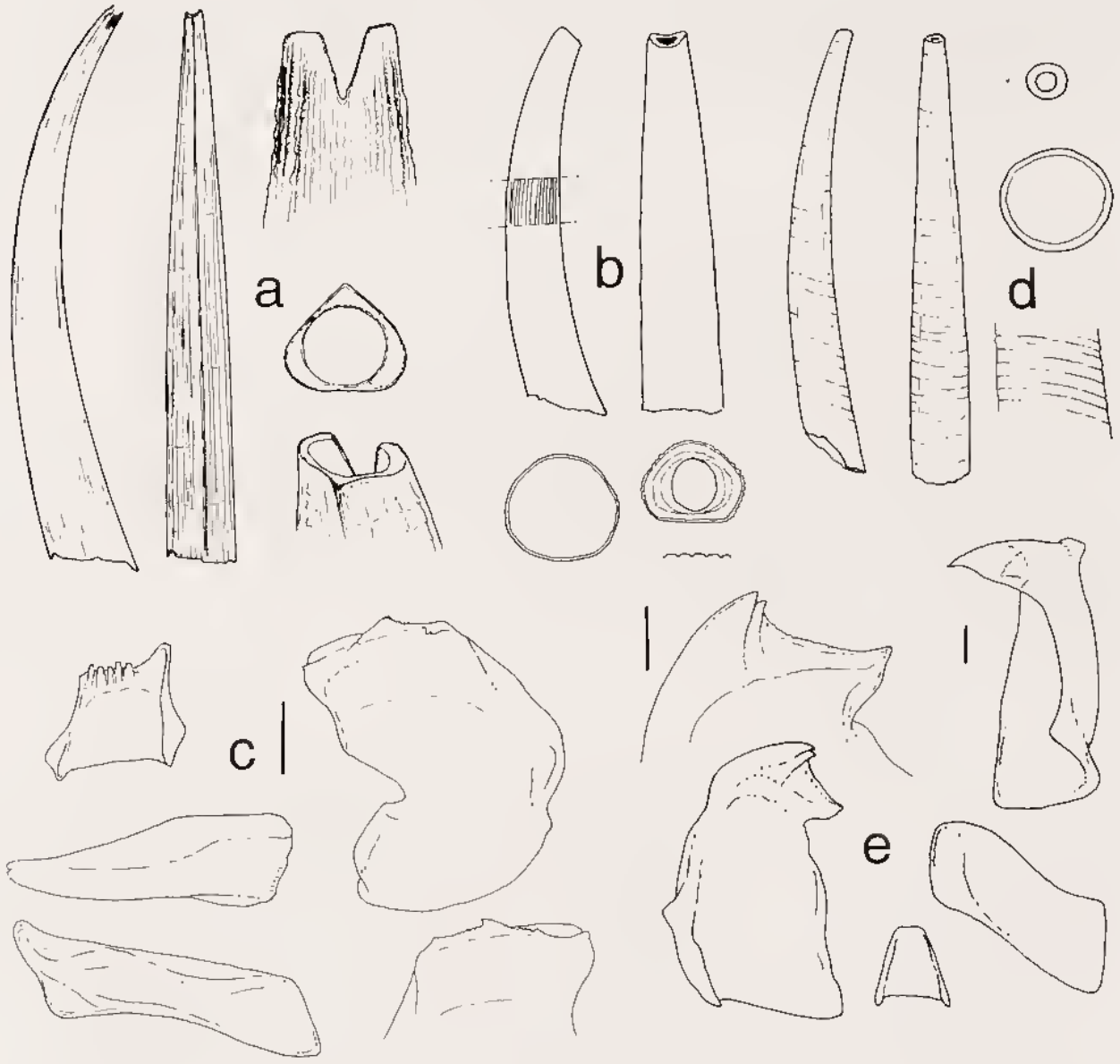


FIG. 174. — **a**, *Megaentalina mediocarinata*, shell (34 mm), lateral and dorsal views, apex and apical sections (USNM). — **b**, *Megaentalina cornucopiae*, shell (22 mm), lateral and dorsal views, apical and oral sections, section of sculpture, ESTASE 2: stn DR 4. — **c**, *Megaentalina* type radula (*M. mediocarinata*); see also Fig. 172 e. — **d**, *Compressidens infimus* sp. nov., holotype, shell (4 mm), lateral and dorsal views, apical and oral sections, detail of sculpture. — **e**, *Compressidens* type radula (*C. ophiodon* Dall, 1881, Northern Brazil).

Source : MNHN, Paris

Other Indo-Pacific species of *Compressidens* cited in the literature

Compressidens comprimatum (Plate, 1908a): 349, pl. 30, figs 26-34. Zanzibar Channel, *"Valdivia"*, stn 245, 05°28′ S, 39°19′ E, 463 m. Lectotype (KILIAS, 1995) ZMB 61101a.

Compressidens kikuchii (Kuroda & Habe, 1952): 9, pl. 1, figs 3-4. Toyama Bay, Honshu, Japan. NSMT.

Compressidens platyceras (Sharp & Pilsbry *in* Pilsbry & Sharp, 1897): 126, pl. 22, figs 58-60. East Australia, Salamander Bay, Port Stephens, New South Wales, 4-8 fms [7-15 m]. Syntypes ANSP 35565 and AMS 55085, 11721.

GENERAL DISCUSSION

The total number of scaphopod species present in discrete geographical subregions of the Indo-Pacific is presented in Table 2. Estimated figures are based on bibliographic sources cited in this paper, as well as actual examination of material. It is likely that data in this Table will become obsolete as new regional revisions, such as the scaphopod part of the ongoing *Fauna of Australia* by HEALY & LAMPRELL, are published. With 73 species currently recorded from there, New Caledonia is now the area with the highest documented scaphopod diversity in the Indo-Pacific. Undoubtedly, differences among different regions reflect intensity in sampling effort, as well as genuine differences in global faunal diversity. Thanks to the series of MUSORSTOM expeditions in the New Caledonia area, the collecting effort in that part of the SW Pacific has been considerably higher than in any other part of the Indo-Pacific of similar size. The total of 73 New Caledonian species represents 53% of the total number of scaphopod species recorded in the present paper, and 31% of the total Indo-West Pacific fauna (237 species). This proportion is particularly remarkable in view of the small size (less than 2 million km^2) of the New Caledonia Exclusive Economic Zone compared to the total extent of the Indo-Pacific region (over 150 million km^2).

TABLE 2. — Estimated number of scaphopod species in selected regions

Region	Total	Dentaliida	Gadilida
Japan	50	30	20
Indonesia	65	41	24
Philippines	50	39	11
Indian Ocean	62	33	29
China Seas	26	22	4
N and E Australia	22	17	5
South Africa	15	10	5
New Zealand	12	5	7
Hawaii	5	3	2
New Caledonia	73	43	30

Source : MNHN, Paris

BATHYMETRIC DISTRIBUTION

Sampling effort in New Caledonia has been rather even between 0 and 2000 m. The fauna deeper than 2000 m is less adequately surveyed, and there are no samples from deeper than 3750 m. Figure 175 illustrates the number of species found at discrete depth intervals in New Caledonia: 0-100, 100-300, 300-500, 500-800, 800-1200, 1200-2000, 2000-3000 and 3000-4000 m. Because a species may have different bathymetric ranges at different latitudes and/or in different hydrological regimes, only depth data for New Caledonia have been considered. Of the 73 species recorded, 48 have been collected alive. For the remaining 25 species, bathymetric ranges are based on empty shells since they apparently depict patterns that are both coherent and consistent with what is known of the depth range of the same species elsewhere in the Indo-Pacific.

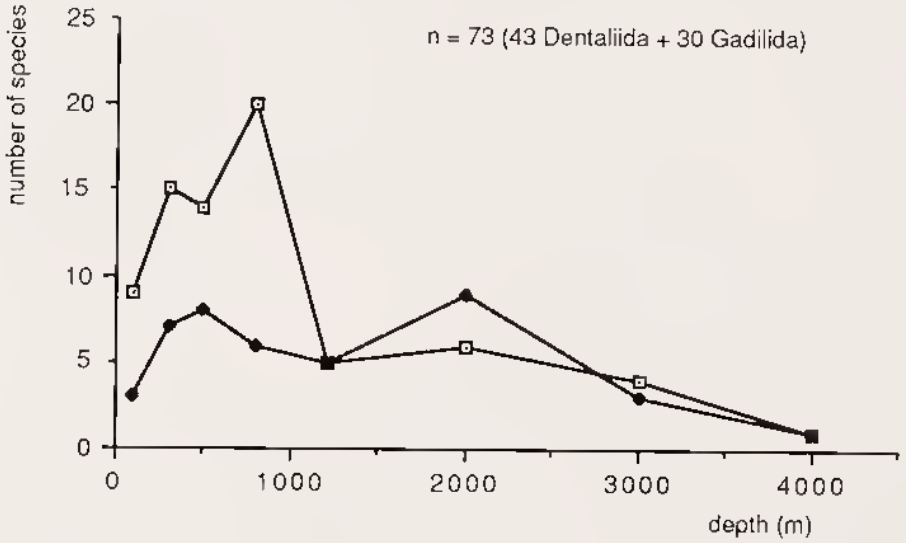


FIG. 175. — Bathymetric distribution of the scaphopod fauna of New Caledonia. Open square: Dentaliida; black square: Gadilida.

The diversity of both Dentaliida and Gadilida increases from 0 to 500 m, is maximal in the 500-800 m depth interval, and decreases abruptly in the 800-1200 m interval. Deeper than 1200 m, the number of Dentaliida continues to decrease, whereas Gadilida show a second, minor peak in 1200-2000 m. In Dentaliida, *Fissidentalium* is most diverse in the deep sea (mostly bathyal and abyssal), other genera being equally represented at all depths. The second peak of the Gadilida is mostly formed by representatives of Entalinomorpha and *Siphonodentalium*. Similar patterns have been noted in the Atlantic Ocean (SCARABINO, 1979, 1986a-b, and unpublished observations) and point to distinct radiation patterns of Dentaliida and Gadilida in the deep-sea.

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Source : MNHN, Paris

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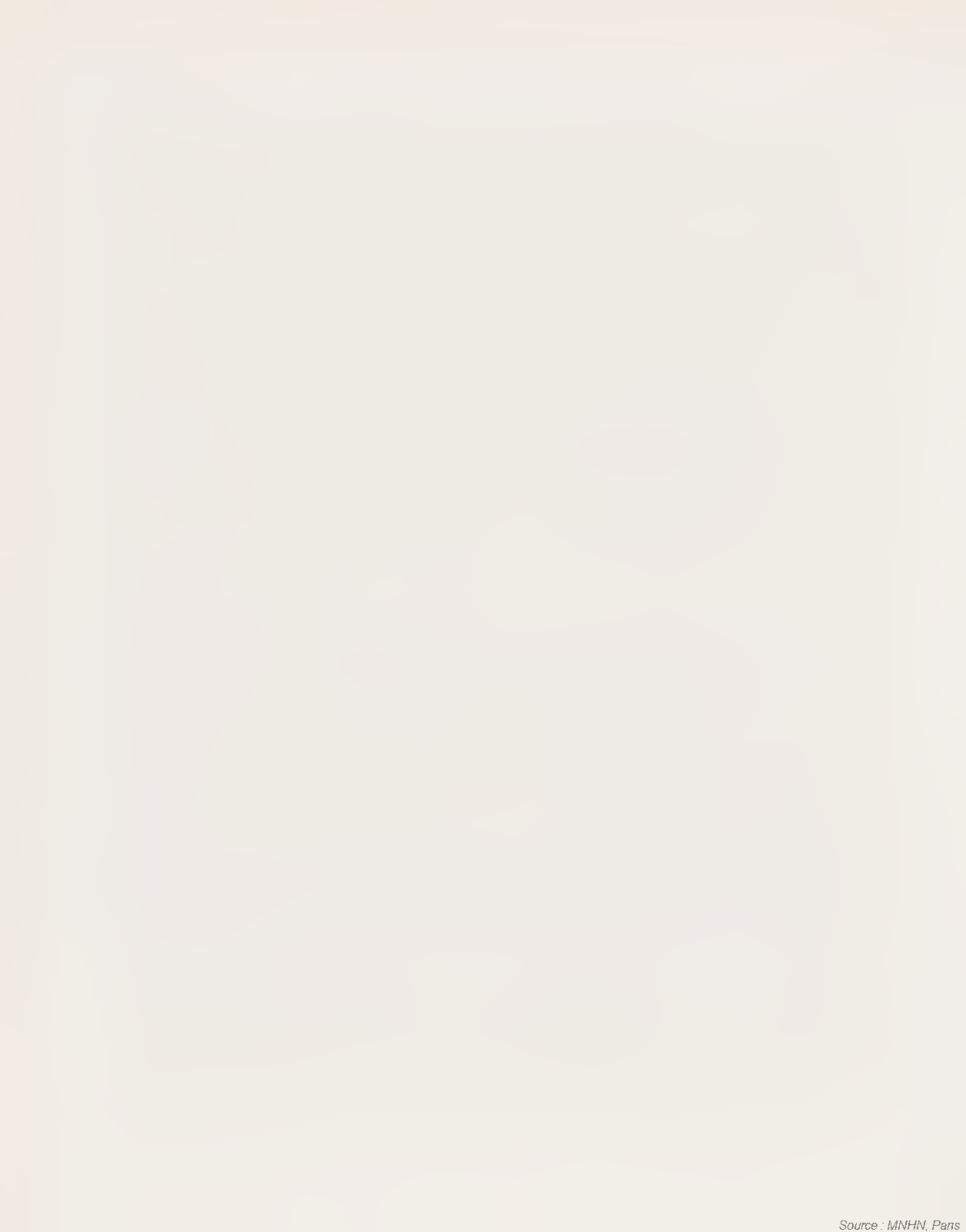
Source : MNHN, Paris



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5

Calliostomatidae (Gastropoda: Trochoidea) from New Caledonia, the Loyalty Islands, and the northern Lord Howe Rise

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ABSTRACT

Thirty species (27 new) of Calliostomatidae are recorded from the study region, all but two of which are new records. An additional new species is based on material from northern New Zealand. They are referred to *Fautor* Iredale, 1924, *Benthastelena* Iredale, 1936, *Ampullotrochus* Monterosato, 1890 (as subgenera of *Calliostoma* Swainson, 1840), *Bathyfautor* gen. nov., *Dactylastele* gen. nov., *Laetifautor* Iredale, 1929, *Selastele* gen. nov., *Fautrix* gen. nov., and *Thysanodonta* Marshall, 1988. A new tribe, Fautricini, is introduced for species with a radula that is evidently the most primitive (plesiomorphic) in the family, and Fautricini either represents the common basal stock or an early offshoot from it. Calliostomatidae is treated as a family within Trochoidea rather than a subfamily of Trochidae as has been traditional. Three calliostomatid genus group taxa are newly synonymised: *Tristichotrochus* Ikebe, 1942 (= *Benthastelena* Iredale, 1936), *Salsipotens* Iredale, 1924 (= *Astele* Swainson, 1840), *Spicator* Cotton & Godfrey, 1935 (= *Laetifautor* Iredale, 1929). Criteria used for taxonomic discrimination, evolutionary history, and some biogeographical observations are discussed. All calliostomatid genus group taxa and taxa removed (some newly) from the family are listed in appendices. A lectotype is designated for *Zizyphinus scobinatus* A. Adams, 1863.

RÉSUMÉ

Les Calliostomatidae (Gastropoda: Trochoidea) de Nouvelle-Calédonie, des îles Loyauté et du Nord de la Ride de Lord Howe.

Trente espèces (dont 27 espèces nouvelles) de Calliostomatidae sont recensées dans la région considérée, et toutes sauf deux représentent des signalisations géographiques nouvelles. Une autre espèce nouvelle est décrite à partir de matériel du Nord de la Nouvelle-Zélande. Les espèces sont classées dans les genres *Fautor* Iredale, 1924, *Benthastelena* Iredale, 1936, *Ampullotrochus* Monterosato, 1890 (traités comme sous-genres de *Calliostoma* Swainson, 1840), *Bathyfautor* gen. nov.,

MARSHALL, B.A., 1995. — Calliostomatidae (Gastropoda: Trochoidea) from New Caledonia, the Loyalty Islands, and the northern Lord Howe Rise. *In*: P. BOUCHET (ed.), Résultats des Campagnes MUSORSTOM, Volume 14. *Mém. Mus. natn. Hist. nat.*, **167**: 381-458. Paris ISBN 2-85653-217-9.

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Source : MNHN, Paris

Dactylastele gen. nov., *Laetifautor* Iredale, 1929, *Selastele* gen. nov., *Fautrix* gen. nov., et *Thysanodonta* Marshall, 1988. La nouvelle tribu Fautricini, créée pour les taxons dont la radula est apparemment la plus primitive (plésiomorphe), représente le stock ancestral de la famille ou une branche ancienne de celui-ci. Calliostomatidae est traité comme une famille de Trochoidea, et non simplement comme une sous-famille de Trochidae comme il est habituel de le faire. Trois noms du groupe-genre sont mis en synonymie: *Tristichotrochus* Ikebe, 1942 (= *Benthastelena* Iredale, 1936), *Salsipotens* Iredale, 1924 (= *Astele* Swainson, 1840) et *Spicator* Cotton & Godfrey, 1935 (= *Laetifautor* Iredale, 1929). Les caractères utilisés pour la systématique et l'histoire évolutive de la famille sont discutés, de même que diverses observations de biogéographie. Une liste complète des taxons du groupe-genre appartenant à la famille Calliostomatidae, ainsi qu'une liste de ceux qui en ont été exclus (certains pour la première fois dans ce travail), figurent en appendice. Un lectotype de *Zizyphinus scobinatus* A. Adams, 1863 est choisi.

INTRODUCTION

During the last few decades French oceanographic expeditions have sampled benthic biota at over 600 dredge and trawl stations off New Caledonia, the Loyalty Islands and on the Lord Howe Seamount Chain (RICHER DE FORGES, 1990). The resulting material (MNHN) is by far the richest and most comprehensive collection of benthic tropical biota ever assembled from the Indo-Pacific, particularly from depths greater than 100 metres on rugged substrata. The molluscan material includes many hundreds of undescribed species and great numbers of new distributional records. These collections dramatically reveal how little is actually known of the biotas occurring on seamounts and off tropical islands in general, especially in the western Pacific, and they probably afford a mere hint of the species richness in this huge region. Through the generosity of Dr Philippe Bouchet (MNHN), I am privileged to be able to describe the rich calliostomatid material from these collections.

Calliostomatids are trochiform gastropods that range from about 8-100 mm in shell height. They are exclusively marine and occur in all oceans from the intertidal zone to about 3,000 metres depth, typically on rocky substrata. Related to trochids they are characterised by a distinctive protoconch sculpture and radular morphology. The group is richly speciated with more than 250 valid Recent species, including those named herein. About 300 fossil taxa have been named. While many of the fossils are doubtfully or categorically not calliostomatids or are synonyms, I have personally examined about 70 undescribed Tertiary species (mainly from Australia and New Zealand) as well as a similar number of undescribed Recent species. Whereas some species are commonly found associated with algae, gut contents and field observations reveal that all are carnivores when adult, feeding mostly upon Cnidaria and, to a lesser extent, sponges or carion.

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

AMS : Australian Museum, Sydney
BMNH : The Natural History Museum, London
LACM : County Museum of Natural History, Los Angeles
MNHN : Muséum national d'Histoire naturelle, Paris
NMNZ : Museum of New Zealand, Wellington
NMP : Natal Museum, Pietermaritzburg
NSMT : National Science Museum, Tokyo
NZGS : Institute of Geological and Nuclear Sciences, Lower Hutt
NZOI : National Institute of Water and Atmospheric Sciences, Wellington
USNM : National Museum of Natural History, Washington DC

Source : MNHN, Paris

Other abbreviations

D : Diameter
H : Height
P : Primary spiral (Fig. 1)
S : Secondary spiral (Fig. 1)
TW : Teleoconch whorls (number)
dd : no live-taken specimens present in sample
lv : live-taken specimens present in sample
spm : specimen, condition unknown
OD : Original designation
SD : Subsequent designation.

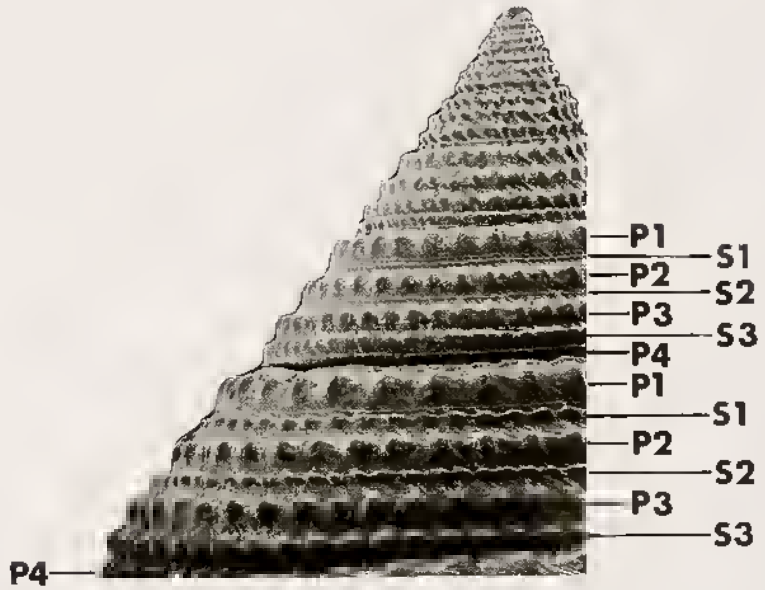


FIG. 1. — Key to standard calliostomatid spiral cord numbers on two whorls of *Calliostoma (Maurea) osbornei* Powell, 1926 (off Cape Maria van Diemen, New Zealand, 38-43 m. NMNZ M74665, × 7). P = primary spiral cord, S = secondary spiral cord.

Height precedes diameter in all given dimensions. All shell measurements were taken on the longitudinal axis or at right angles to it. Unless specified, all material is in Muséum National d'Histoire Naturelle, Paris.

SYSTEMATIC ACCOUNT

Subclass PROSOBRANCHIA Milne Edwards, 1848

Order VETIGASTROPODA Salvini-Plawen, 1980

Superfamily TROCHOIDEA Rafinesque, 1815

Family CALLIOSTOMATIDAE THIELE, 1924

DIAGNOSIS. — *Shell* trochiform or turbiniform, 8-100 mm high, umbilicate or anomphalous, internally nacreous. Protoconch sculptured with network of threads that enclose roughly hexagonal spaces. First teleoconch whorl convex, subsequent whorls flat to convex or angulate; sculpture rarely absent, usually consisting of nodular spiral cords that multiply by intercalation (rarely by fission) and

Source : MNHN, Paris

axial riblets, the axials generally restricted to earliest whorls, though in some species persistent throughout. Operculum chitinous, thin, multispiral. *Radula* (adult) with the formula ∞ + 1-17 + 1 + 17-1 + ∞, tooth morphology very diverse (see subfamily diagnoses); lateral teeth added incrementally by intercalation in the central field in Calliostomatinae, and by morphological transformation of marginal teeth in Fautricini. Jaw plates large, buccal musculature very strong. Cephalic tentacles elongate, tapered, papillate, well developed eyes on swellings at their outer bases in all species examined. Snout tip papillate, ventral lip split and rolled to form an incomplete tube (pseudoproboscis), dorsal lip with a cuticularised lining that extends into buccal cavity. Epipodium well developed with prominent neck lobes. Cephalic lappets large, small or absent. Up to five prominent epipodial tentacles on each side, side of foot papillate. Sexes separate. (See FRETTER & GRAHAM, 1962, 1977 for more detailed anatomical data).

REMARKS. — Interpretation of the relationships between calliostomatid species and thus resolution of actual or potential phylogenetic radiations within the family has proved to be extremely and unusually difficult. This is due primarily to the fact that radular morphology and external anatomy are in general highly conservative within the major groups. Many groups of species that seem to represent independent phylogenetic radiations on the basis of distinctive combinations of shell characters, cannot be neatly defined as genera or subgenera because, considered together with other species, there is a bewildering mosaic of intermediate character states. Shell shape and sculpture, though diverse, are generally variations on a very limited theme, and it is clear that many of the most pronounced differences are merely the result of accelerated or retarded development, often in apparently closely related species. In most calliostomatids (i.e. most Calliostomatinae), the first few teleoconch whorls are convex and sculptured with four strong primary spiral cords (P1-P4, see Fig. 1), P4 being peripheral and more or less covered by succeeding whorls. On the first whorl P1-P4 or P2-P4 typically commence simultaneously, and P1 is usually either weaker than P2 and P3 when commencing simultaneously, or it appears later. With subsequent growth the whorls typically become flatter-sided, P1-P3 remain similar, or P1 becomes larger than P2 and P3, and spiral cords are multiplied by intercalation of secondaries and sometimes tertiaries. In some species P2 and P3 become relatively stronger after the first whorl and may remain relatively strong throughout, any secondary spirals that intercalate between them typically remaining substantially weaker than the primaries (compare Figs 49 and 55). While there are exceptions, particularly large spiral cords tend to occur in species with convex whorls and in which P1 either is relatively weak throughout, appears very late, or entirely fails to develop. Adults of these species resemble their own juvenile stages to some extent, and it seems that they are paedomorphic, with retarded somatic development. Polarity for these character states, however, cannot be resolved without knowledge of the fossil record. Calliostomatids that are considered to have "juvenilized" adult shell morphology include species of *Laetifautor*, *Coralastele*, *Otukaia*, *Omphalotukaia*, and some species of *Benthastelena*. Since phylogenetic groups (*e.g.* genera) within the family naturally comprise species in which character states are accelerated or retarded to varying degrees, conspicuous differences in shell morphology such as whorl convexity alone may not necessarily be suitable for discrimination at generic or subgeneric level.

Major interspecific differences in radular morphology include the shape of the central tooth, the number and shape of the lateral teeth, and features of the marginal teeth, especially the innermost pair. As recently demonstrated by WARÉN (1990), calliostomatid radulae undergo pronounced changes with increasing shell size/age, which include a progressive change in shape and increase in number of lateral teeth (by intercalation) and a change in shape of the innermost pair of marginal teeth. As with the shell, differences in the radula, particularly the number of lateral teeth, cannot be utilised for genus group discrimination in isolation, since development of this organ structure is obviously accelerated or retarded to varying degrees in related species.

When viewed on a worldwide basis, a number of more or less nebulous natural (phylogenetic) groups are recognisable, though most of them have proved to be unusually difficult to quantify or

Source : MNHN, Paris

to define objectively with traditional methods, particularly with due consideration to heterochrony. Molecular cladistic techniques would seem to be a promising source of data for resolution of the phylogenetic structure of this family, and indeed for the whole of the Trochoidea.

Included genera and subgenera are listed in Appendix 1. For genus group taxa removed from the family see Appendix 2.

Protoconch. — The calliostomatid protoconch is highly distinctive in having a sculptural network of crisp threads that enclose more or less hexagonal spaces, and in having a thickened apertural rim. Thread thickness, enclosed space size, overall protoconch size, and degree of exsertion (tilting) are interspecifically variable and intraspecifically highly stable. The shape of the tip of the apical fold may be rounded or tightly pinched, an obese protoconch evidently reflecting a large yolk supply. Bandel (1982) has shown that the surface sculpture is secreted after deformation (folding) of the protoconch, presumably via solute transmission through the semipermeable outer shell layer at an early stage of mineralisation. The fully mineralised shell is almost perfectly bilaterally symmetrical, and so far no species have been noted in which the tip of the apical fold bulges abapically as in some trochids (Hadfield & Strathmann, 1990). Incidentally, these latter authors misinterpreted trochids with abapically bulging protoconch tips as having "heterostrophic" shells. This is incorrect, because the archaeogastropod protoconch is asymmetrically (in this case) or symmetrically folded about an axis, and there is no accretionary shell growth.

Teleoconch I. — All known calliostomatines exhibit a pronounced growth scar on the first quarter teleoconch whorl, the position of which is interspecifically variable though intraspecifically rather stable (Figs 2-3). Sculpture before the scar comprises 4-6 fine, crisp, similar spiral threads, and usually 1, 2 or more varices. Sculpture immediately after the scar is usually discordant (Fig. 2), though a few species exhibit a rather fluid transition to succeeding teleoconch sculpture, usually accompanied by a sudden increase in the strength of the spiral sculpture (Fig. 3). From descriptions of calliostomatids reared in aquaria (Lebour, 1936; Holyoak, 1988; Ramon, 1990; K. Bandel pers. comm.), teleoconch accretion commences immediately or soon after formation of the terminal varix of the protoconch (here interpreted as the point of settlement). During the period of initial teleoconch formation the young evidently subsists on residual yolk, the resorbed velum, and perhaps dissolved organic matter, probably increasingly supplemented by detritus ingested from the substratum. It seems clear that the postlarval scar represents a growth pause or a crisis period and I suggest that it may denote the transition to exclusive detritivory (later transitional to carnivory). It may actually mark the transition to carnivory, at least in some species, though the radula may be insufficient to deal with Cnidaria or sponges at such an early stage of development. This interpretation is at variance with that of Hickman (1992: fig. 5G) who identified the terminal protoconch varix and the varix following it as denoting the times of hatching and settlement respectively. Note that the postlarval scar in the species illustrated by Hickman is situated immediately on the adapertural side of the varix *following* that denoted as time of "settlement".

Teleoconch II. — With the exception of a few more or less smooth species, the majority of calliostomatids are sculptured with prominent (usually nodular) spiral cords and axial costae, the latter generally confined to the early spire whorls. There are usually four primary spiral cords (P1-P4, Fig. 1) on the early spire whorls, to which others are added by intercalation (rarely fission) of secondary spirals (S1-S3) and sometimes one or more tertiary spirals that may enlarge to resemble the primaries or secondaries. The number, spacing, relative size, rate of enlargement, position, point of origin, and cross-sectional shape of spiral cords are primary criteria for discrimination of species group taxa. Sculpture tends to be intraspecifically highly stable on the early spire whorls, and increasingly variable on later whorls, due primarily to intercalation of varying numbers of tertiary spirals at varying positions with varying rates of enlargement. Accordingly, for descriptions and discrimination of taxa, careful attention must be paid to the origin and development of individual

Source : MNHN, Paris

elements of the spiral sculpture by tracing them from the beginning of the teleoconch — mere counting of the number of spiral cords on particular whorls is virtually useless. Unequivocal objectivity can only be achieved through rigorous application of the excellent spiral designation system initiated by IKEBE (1942), which is reproduced here for convenience (Fig. 1).

Sculptural features combine to produce an infinite variety of distinctive, intraspecifically stable gross shell facies, particularly on the early teleoconch. Natural (phylogenetic) groups segregated on the basis of highly distinctive radular morphology (e.g. *Astele*, *Laetifautor*, *Fautrix* gen. nov. and *Thysanodonta*) tend also to have distinctive early teleoconch facies. Nevertheless, even highly distinctive shell facies are typically impossible to quantify and very difficult to describe objectively (especially with verbal economy), so illustrations (SEM) are an integral component of my genus group diagnoses.

RADULA. — As recently shown by WARÉN (1990), the calliostomatine radula is distinctive among trochoideans in that the innermost pair of marginals become greatly enlarged at an extremely early stage of ontogenesis, after which the central and lateral teeth arise by intercalation in the central field. In other trochoideans (and apparently in the new calliostomatid tribe Fautricini — see below) the lateral teeth arise through progressive in-column morphological transformation of marginal teeth, and any additional laterals are added pair by pair through transformation of successive columns of marginals. For comparative purposes, therefore, it is clearly essential to compare radulae from individuals at equivalent stages of development, ideally maturity since related species will naturally differ in rates of somatic development.

Calliostomatine radular morphology is on the whole exceedingly conservative, and species with highly divergent shell morphologies commonly have fundamentally similar radulae. Nevertheless there is interspecific variation and intraspecific stability in the relative size, shape, and number of teeth and cusps in adult radulae. The overall shape of the central and lateral teeth and the sizes of their basal plates cannot be determined from standard SEM views of artificially protracted radulae because these teeth are longer than broad, crowded, strongly curved and typically flexible. Tooth outline can be accurately determined only by flattening excised individual teeth, while the relative sizes of the basal plates are best determined by light microscopy of stained preparations using substage lighting. While experimental use of these techniques on various species revealed many taxonomically significant features, they are omitted from the present study not only because of time constraints, but also because shell and gross radular characters are considered to be adequate for discrimination of species and most supraspecific groups. Most natural (phylogenetic) groups that can be discriminated on shell morphology tend also to have characteristic numbers of lateral teeth, for example species of *Laetifautor* have only one pair of laterals, while the type species of *Venustatrochus* has as many as 17 pairs per transverse row. The majority of calliostomatines have 5-9 pairs of laterals at maturity and interspecific variation by 1 or 2 pairs is common within groups of closely related species. The low number of lateral teeth in *Laetifautor* species and the exceptionally small size of the lateral and central teeth with respect to the innermost marginals strongly suggests that development of the radula is retarded (Figs 136-137). Unlike juvenile calliostomatids (WARÉN, 1990: fig. 6B), teeth in the central field in *Laetifautor* are slender with serrated edges, which suggests that the condition is the result of a paedomorphic process rather than a primary one. By contrast, the adult radula in species of *Selastele* gen. nov. (Figs 138-139) have exceptionally high numbers of lateral teeth relative to body size, yet few marginal teeth (as in juveniles), while all of the teeth are weakly solidified and semigelatinous. The number of marginal teeth has evidently been reduced by a paedomorphic process that has differentially failed to retard multiplication of the lateral teeth during ontogenesis. For *Selastele* the large number of lateral teeth and dissimilarity between young and adult teleoconch suggests that small size is the result of dwarfism rather than a paedomorphic process.

DIET AND FEEDING MODE. — Although shallow water calliostomatines are frequently observed in association with algae, careful field observations and examination of gut contents reveals that all are

Source : MNHN, Paris

obligate carnivores (MARSHALL, 1988; FERRO & CRETELLA, 1993). The majority of species feed on Cnidaria (commonly hydroids), and a few feed exclusively on sponges. From examination of many radulae from about 100 species of calliostomatids from throughout the world belonging to a variety of genera and subgenera, the only teeth that exhibit any significant degree of wear are the enlarged innermost pair of marginals. Evidently, therefore, all of the other teeth are involved primarily in food retention and clasping for transportation into the mouth.

When an excised calliostomatine radula is stretched apart and bent as if it were being pulled around the tip of the odontophore, the innermost pair of marginal teeth stand vertically and rigid with their laterally compressed vertical cutting areas aligned on the longitudinal axis. Thus the columns of innermost marginals function like a pair of chainsaws as the radula is worked back and forth around the odontophore tip by the massively developed buccal muscles. The tips of the (flexible) immediately adjacent laterals are commonly observed to be cleanly broken or entirely missing at the anterior end of the radula, and this damage is clearly incurred through accidental emplacement between the slashing innermost marginals and the prey/substratum. Several species are known in which the "cutting" areas are naturally absent from the outermost 1-3 pairs of laterals throughout the entire adult radula. It is possible that these "cutting" areas are progressively reduced during ontogenesis or they may simply never develop (juvenile radulae not seen).

In the new tribe Fautricini (see below), all of the innermost 9 pairs of marginal teeth are greatly enlarged and strengthened during ontogenesis, and clearly all of them are directly involved in food preparation (Figs 144-145). MARSHALL (1988) hypothesised that the bizarre radula in Thysanodontinae (Figs 148-149) may be somehow involved in suctorial feeding.

Subfamily CALLIOSTOMATINAE Thiele, 1924

DIAGNOSIS. — *Shell* as for Calliostomatidae. *Radula* with the formula ∞ + 1-17 + 1 + 17-1 + ∞. Central and lateral teeth typically thin or very thin in section, with angulate, finely serrate tips. Innermost pair of marginal teeth typically shorter and stouter than other marginals, and modified to some degree. Outer marginals slender with narrow, finely serrate tips; outermost few marginals usually with blunt, cuspless tips and often fused.

Included genera and subgenera: see appendix 1.

Genus *CALLIOSTOMA* Swainson, 1840

Calliostoma Swainson, 1840: 218, 351. Type species (SD by HERRMANNSEN, 1846: 154): *Trochus conulus* Linnaeus, 1758; Recent, north eastern Atlantic and Mediterranean.

Synonyms:

Ziziphinus Gray, 1840: 151 = *Nomen nudum*.
Conulus Nardo, 1841: 244. Type species (OD): *Trochus conulus* Linnaeus, 1758 (not *Conulus* Leske, 1778, not Fitzinger, 1833).
Ziziphinus Gray, 1842: 57. Type species (SD by GRAY 1847: 145 and by tautonomy): *"Trochus ziziphinus"* = *Trochus zizyphinus* Linnaeus, 1758; Recent, north eastern Atlantic and Mediterranean.
Zizyphinus Gray, 1847: 237. Incorrect subsequent spelling of *Ziziphinus* Gray, 1842.
Callistoma/Callistomus Herrmannsen, 1846: 154, 1852: 22. Unnecessary emendations of *Calliostoma* Swainson.
Jacinthinus Monterosato, 1889: 79. Type species (SD by CLENCH & TURNER, 1960: 11): *Trochus conulus* Linnaeus, 1758.

REMARKS. — SWAINSON (1840: 218) first introduced *Calliostoma* as a subgenus of *Trochus* Linnaeus, 1758 with the entry "... forming our subgenus *Calliostoma* ... *Trochus zizyphinus* of British writers will give a very good idea of these shells ...". This does not constitute original designation of a type species (ICZN Art. 67c). Contrary to the opinion of some authors (e.g. CLENCH & TURNER, 1960; ABBOTT, 1974), *T. zizyphinus* is not type species by monotypy either (Art. 68d), since SWAINSON (1840: 351) included eight taxa in the formal diagnosis of *Calliostoma*, including *T. zizyphinus* and *T. conulus* (as *zizyphina* and *conula*). Since no type species was designated, the type species is *T. conulus* through subsequent designation by HERRMANNSEN (1846: 154) (Art. 69a).

Source : MNHN, Paris

At its earliest introduction by GRAY (1840: 151), *Ziziphinus* appears in a list without associated species, description or comment and is thus a *nomen nudum* (IREDALE, 1913). At the second introduction the name is again without associated species, GRAY (1842: 57) stating (under *Thalotia*) "in *Ziziphinus, Cantharidus*, and *Thalotia* the mouth is oblong and simple and the axis is covered by the inner lip; the former is top-shaped, the Cantharidi are ovate and green within". The first use of *Zizyphinus* (note spelling) in connection with nominate species was by GRAY (1843: 237) who included four New Zealand species and two mislocalised North American species. GRAY (1847: 145) subsequently designated the European species *T. ziziphinus* (i.e. *Trochus zizyphinus* Linnaeus, 1758) as type species of *Ziziphinus* Gray, 1840, while REHDER (1937: 115) selected the North American species *Trochus canaliculatus* "Martyn" Lightfoot as type species of *Zizyphinus* Gray, 1843. On the face of it, therefore, *Ziziphinus* and *Zizyphinus* would seem to be distinct genus group taxa with separate type species, and they were so interpreted by KEEN (1960). It seems preferable, however, to treat *Ziziphinus* in the spirit with which it was intended (tautonomy), and interpret *T. zizyphinus* as type species of *Ziziphinus* Gray, 1842 by subsequent designation of GRAY 1847. Gray's *Zizyphinus* is eliminated as an incorrected subsequent spelling since it is neither a mandatory change nor a demonstrably intentional emendation (ICZN Art.33). Consequently REHDER's (1937: 115) selection of *T. canaliculatus* as type species of *Zizyphinus* was unnecessary.

Subgenus *CALLIOSTOMA* (*s. str.*) Swainson, 1840

DIAGNOSIS. — *Shell* up to about 35 mm high, stout, narrowly to broadly conical, periphery rounded or angulate, anomphalous. P1-P4 commencing immediately or P1 later, strong to very strong, persisting or becoming obsolete; axial sculpture very weak or absent, nodules absent or large and bluntly rounded. *Animal* with large left and right neck lobes, and 3 or 4 small epipodial tentacles on each side. Cephalic tentacles tapered, extending little beyond tip of snout. Central and lateral teeth broad-based, thin in section and flexible, laterals with very slender tips. Jaw plates with short elements at anterior margins.

REMARKS. — The concept of *Calliostoma* (*s. str.*) is here restricted to the following taxa: *C. conulus* (Linnaeus, 1758), *C. zizyphinum* (Linnaeus, 1758), *C. laugieri* (Payraudeau, 1826), *C. occidentale* (Mighels, 1842), *C. gualtierianum* (Philippi, 1848), *C. hirondellei* Dautzenberg & Fischer, 1896, *C. grimaldii* Dautzenberg & Fischer, 1896, *C. cleopatra* (Fischer, 1898), *C. laqueatum* (Locard, 1897) and *C. oppansum* (Locard, 1897). All of these occur in the north eastern Atlantic and/or Mediterranean, with the exception of *C. occidentale*, which occurs in the north eastern and north western Atlantic. The limits of morphological expression within the subgenus are uncertain, and I have only included species that seem most likely to represent a tight phylogenetic radiation. Inclusion of *C. occidentale*, perhaps the most divergent in shell morphology, provides both morphological and geographical links between eastern and western Atlantic species groups.

Three groups of western Pacific species with rather distinctive shell facies are here referred to subgenera *Ampullotrochus*, *Fautor*, and *Benthastelena*. Despite the extreme conservatism of *Calliostoma* (*s. lat.*) world wide, these groups all seem to represent separate phylogenetic radiations. Indeed one or more of them may eventually prove to be worth recognising as genera, but until the family is better known I prefer a conservative approach. As stated above these groups are difficult to objectively define in that the combinations of character states are difficult to quantify or verbalise.

Judging from illustrations, the following Recent European species may not belong in *Calliostoma* (*s. str.*) and their precise relationships within Calliostomatidae are uncertain: *Calliostoma caroli* Dautzenberg, 1927, *C. leptophyma* Dautzenberg & Fischer, 1896, *Z. milneedwardsi* Locard, 1897, *C. normani* Dautzenberg & Fischer, 1897, *Z. triporcatus* Fischer *in* Filhol, 1886.

Source : MNHN, Paris

Subgenus *Fautor* Iredale, 1924

Fautor Iredale, 1924: 230. Type species (OD): *Ziziphinus comptus* A. Adams, 1855; Recent, southern Australia.

Remarks. — *Fautor* is here utilised as a subgenus of *Calliostoma* for a group of predominantly Indo-western Pacific taxa that differ from species of *Calliostoma* (*s. str.*) (Fig. 20) in having narrower, more finely beaded spiral cords. I am unable to detect any constant differences between the two groups in the radula, jaws or external anatomy. Although relative size of the spiral cords and nodules admittedly seems rather trivial, viewed as a whole the two groups exhibit a distinctive mosaic combination of character states that is difficult to objectively quantify or describe. Moreover, I am strongly disinclined to treat them as synonyms because *Fautor*, as here limited, is almost certainly polyphyletic.

In addition to the species described herein, the following species are considered to belong in *Fautor*: *Calliostoma admirandum* Smith, 1906 (off Tranvancore), *Zizyphinus allporti* Tenison Woods, 1875 (southern Australia), *Calliostoma funiculare* Melvill, 1906 (Persian Gulf), *Zizyphinus scobinatus* A. Adams, 1863 (Bombay). *Calliostoma takujii* Kosuge, 1986 (Bonin Islands), and perhaps the eastern Atlantic species *C. lithocolletum* Dautzenberg, 1925.

The type species of *Fautor* (*Z. comptus*, Figs 4-6, lectotype Fig. 4) was based on specimens reputedly from New Caledonia, although nothing strictly similar to it has ever been obtained in the New Caledonia region. As correctly concluded by Brazier (1895), the type material is in fact indistinguishable from the New South Wales form of a common indigenous southern Australian species. *C. (F.) comptum* has at times been confused with *Trochus poupineli* Montrouzier, 1875 (*e.g.* Fischer, 1879; Ikebe, 1942; Kosuge, 1984) although in fact Montrouzier's species differs widely and is herein referred to *Dactylastele* gen. nov.

Calliostoma (Fautor) boucheti sp. nov.

Colour Plate; Figs 3, 7-9, 117, 150, 155; Table 1

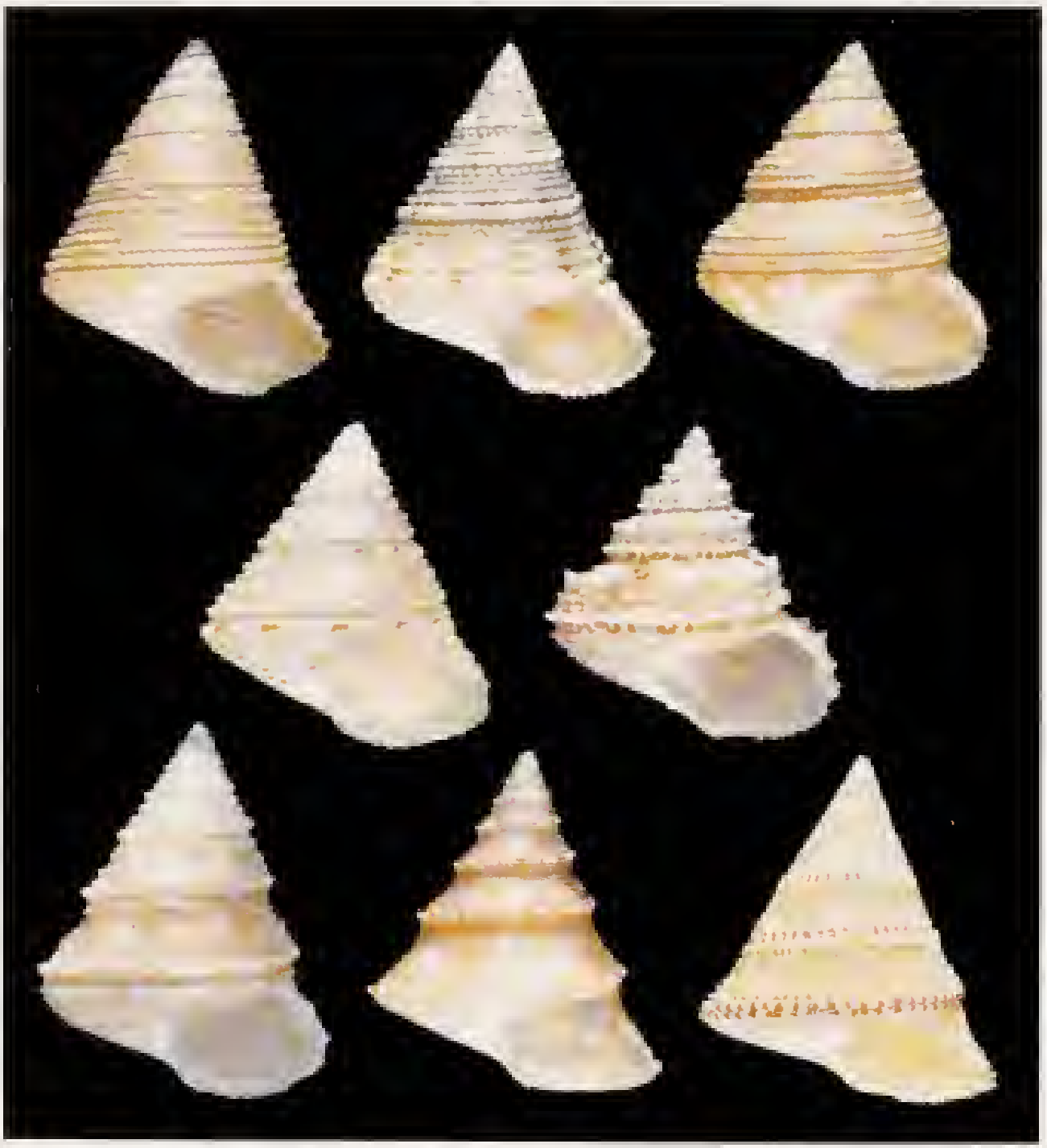
Type material. — Holotype (13.0 × 10.6 mm, 7.30 TW) MNHN. Paratypes: 90 MNHN, 1 AMS C201701, 1 BMNH 1995.013, 1 NMP, 1 USNM, 2 NMNZ M262476.

Type locality. — Off S. New Caledonia, CHALCAL 2, stn DW 75, 24°39′ S, 168°40′ E, 600 m.

Material examined. — All type material. **New Caledonia**. BIOCAL: stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 5 dd (paratypes).
CHALCAL 2: stn DW 72, 24°55′ S, 168°22′ E, 527 m, 33 lv (31 MNHN, 2 NMNZ). — Stn DW 73, 24°40′ S, 168°38′ E, 573 m, 8 lv (1 AMS, 1 BMNH, 4 MNHN, 1 NMP, 1 USNM). — Stn DW 74, 24°40′ S, 168°38′ E, 650 m, 13 lv (paratypes). — Stn DW 75, 24°39′ S, 168°40′ E, 600 m, 4 lv (holotype and 3 paratypes). SMIB 3: stn DW 1, 24°56′ S, 168°22′ E, 520 m, 2 lv (paratypes). — Stn DW 2, 24°53′ S, 168°22′ E, 530-537 m, 8 lv (paratypes). — Stn DW 3, 24°55′ S, 168°22′ E, 513 m, 7 lv paratypes). — Stn DW 5, 24°55′ S, 168°22′ E, 502-512 m, 4 lv (paratypes). — Stn DW 6, 24°56′ S, 168°21′ E, 505 m, 5 lv (paratypes). — Stn DW 7, 24°55′ S, 168°21′ E, 505 m, 5 lv (paratypes). — Stn DW 8, 24°45′ S, 168°08′ E, 233 m, 1 dd (paratype). — Stn DW 22, 23°03′ S, 167°19′ E, 503 m, 2 lv (paratypes).

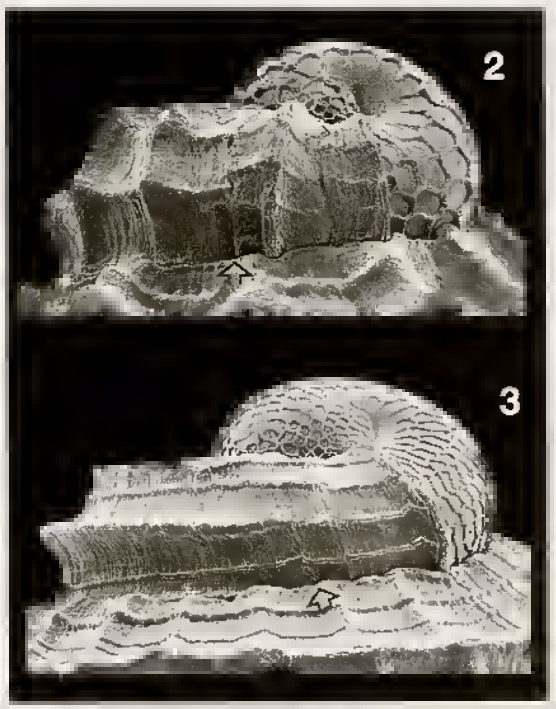
Distribution (Fig. 155). — South of Ile des Pins, southern New Caledonia and northern Norfolk Ridge, 233-650 m, living at 502-650 m.

Source : MNHN, Paris



COLOUR PLATE. — Holotypes of *Calliostoma* species. Top row (left to right): *Calliostoma (Fautor) boucheti*, 13.0 × 10.6 mm; *C. (F.) houbricki*, 12.8 × 10.8 mm; *C. (F.) metivieri*, 11.5 × 9.40 mm. Centre row (left to right): *C. (F.) chesterfieldense*, 7.60 × 6.90 mm; *C. (Benthastelena) diadematum*, 11.0 × 10.5 mm. Bottom row (left to right): *C. (F.) periglyptum*, 10.2 × 8.30 mm; *C. (Ampullotrochus) heros*, 11.6 × 10.2 mm; *C. (A.) xanthos*, 8.00 × 6.90 mm.

Source : MNHN, Paris



FIGS 2-3. — Side views of tip of spire showing postlarval growth scar denoted by arrows. — **2**, *Laetifautor rubropunctatus* (A. Adams). off Swain's Reef, Queensland, 100 m, AMS C153215, × 147. — **3**, *Calliostoma (Fautor) boucheti*, paratype, BIOCAL: stn DW 66, × 123.

DESCRIPTION. — *Shell* up to 13 mm high, rather lightly built, glossy, spire narrowly conical, very weakly cyrtoconoid, 1.92-2.05x as high as aperture, mean spire angle 57-62°, anomphalous.

Colour of protoconch reddish brown. Teleoconch grading from reddish to yellowish brown over 1st 2 whorls, subsequent whorls bright orange to yellowish brown, pale green nacreous layer showing through translucent outer layer in spiral interspaces, inner and outer lip margins white.

Protoconch 400-430 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces. Apical fold tip rounded, terminal varix rounded.

Teleoconch of up to 7.30 whorls; 1st tenth whorl with 4 crisp spiral threads, delineated by growth scar. First 2 whorls strongly convex, angulated at P3, 3rd whorl becoming flat, subsequent whorls flat; periphery angulate, becoming tightly rounded late on last adult whorl, S3 and P3 peripheral; base weakly convex. Spire and basal spirals prominent, rounded, multiplying by intercalation, their rounded conical nodules stronger on spire; axial riblets strong on 1st 3 whorls, becoming obsolete on 4th whorl. P2-P4 commencing immediately after post-larval growth scar: P2 and P3 strong, similar, flange-like and weakly undulant on 1st whorl, becoming nodular on 2nd whorl (P2) and 3rd whorl (P3). P1 a fine thread on 1st whorl, enlarging over 2nd whorl to become as large as P2 and P3 on 3rd whorl, thereafter slightly larger than others. P4 partly covered by succeeding whorls. Secondary spirals enlarging to resemble primaries; S1 commencing late 3rd - mid 4th whorl, S2 commencing end 2nd - late 3rd whorl, S3 commencing mid - end 4th whorl.

Tertiary spirals numbering 1 or more, usually commencing on last adult whorl, remain weaker than primaries and secondaries. Base with 12-17 spiral cords, stronger and more strongly nodular on inner half, nodular on outer half on last adult whorl only. Microsculpture of fine crisp spiral threads on 1st 2 whorls; fine collabral growth lines throughout, crisply defined between P3 and P4 before appearance of S3. Aperture subquadrate. Outer lip thin at rim, slightly thickened within. Inner lip of moderate thickness. No parietal inductura.

Animal creamy white, snout tip laterally expanded, set with slender papillae. Cephalic tentacles long, tapered, finely papillate, prominent eyes at outer bases. Neck lobes thin, left considerably larger and more convoluted, 3 right and 4 left epipodial tentacles. Operculum typical.

Radula (Fig. 117). Central and lateral teeth thin in section with broad, laterally expanded bases. Tip of central tooth narrowly tapered, finely serrate. Lateral teeth similar. 6 pairs in adults; tips very long, slender, finely serrate. Innermost marginal teeth stout, broad-based, with 3 or 4 strong cusps. Outer marginals numerous, tips finely serrate, outermost 5 marginals on each side fused, tips spathulate.

Jaw plate (Fig. 150) with broadly rounded anterior margins, fringing elements short.

Source : MNHN, Paris

TABLE 1. — *Calliostoma (Fautor) boucheti*. Shell measurements (mm) and countings (CHALCAL 2: stns DW 73, DW 74, DW 75).

Character	*n*	Range	Mean	SD
H	15	9.20-13.00	11.39	1.17
D	15	8.30-11.20	09.88	0.91
H/D	15	1.11-01.28	01.15	0.04
TW	15	6.25-07.30	06.85	0.29

REMARKS. — Compared with the superficially similar Australian species *C. (F.) comptum*, *C. (F.) boucheti* differs in numerous details of shell, colour, shape and sculpture. These differences include much finer protoconch sculpture, flange-like cords on the first teleoconch whorl, the later development of P1, and the more evenly conical spire.

ETYMOLOGY. — Named after Philippe BOUCHET (MNHN).

Calliostoma (Fautor) richeri sp. nov.

Figs 10-12, 118, 153; Table 2

TYPE MATERIAL. — Holotype (12.3 × 9.30 mm, 8.10 TW) MNHN. Paratypes: 34 MNHN, 1 AMS C201702, 1 BMNH 1995.014, 2 NMNZ M262470, 1 NMP, 1 USNM.

TYPE LOCALITY. — S. New Caledonia, LAGON, stn 400, 22°34′ S, 167°14′ E, 64 m.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 113, 22°23′ S, 166°48′ E, 32 m, 2 dd (paratypes). — Stn 146, 22°24′ S, 166°55′ E, 40-52 m, 3 dd (paratypes). — Stn 234, 22°33′ S, 166°51′ E, 56 m, 1 dd (paratype). — Stn 240, 22°23′ S, 166°59′ E, 42 m, 1 dd (paratype). — Stn 297, 22°39′ S, 166°46′ E, 30 m, 1 dd (paratype). — Stn 301, 22°35′ S, 166°52′ E, 46 m, 1 dd (paratype). — Stn 303, 22°38′ S, 166°49′ E, 35 m, 1 dd. — Stn 314, 22°39′ S, 166°51′ E, 46 m, 1 dd (paratype). — Stn 315, 22°37′ S, 166°53′ E, 50 m, 1 lv (paratype). — Stn 317, 22°33′ S, 166°53′ E, 66 m, 1 dd (paratype). — Stn 327, 22°26′ S, 167°04′ E, 60 m, 2 dd (paratypes). — Stn 328, 22°27′ S, 167°03′ E, 72 m, 1 dd (paratype). — Stn 332, 22°34′ S, 166°57′ E, 80 m, 2 dd (paratypes). — Stn 350, 22°39′ S, 166°57′ E, 67 m, 2 dd (paratypes). — Stn 352, 22°35′ S, 166°59′ E, 82 m, 1 lv (paratype). — Stn 359, 22°33′ S, 167°04′ E, 74 m, 3 dd (paratypes). — Stn 376, 22°34′ S, 167°06′ E, 75-76 m, 2 dd (paratypes). — Stn 386, 22°37′ S, 167°09′ E, 128 m, 1 dd (paratype). — Stn 400, 22°34′ S, 167°14′ E, 64 m, 11 dd (holotype and paratypes: 4 MNHN, 1 AMS, 1 BMNH, 2 NMNZ, 1 NMP, 1 USNM). — Stn 401, 22°32′ S, 167°15′ E, 49 m, 2 dd (paratypes). — Stn 557, 22°47′ S, 166°54′ E, 44 m, 1 dd . — Stn 565, 22°49′ S, 166°55′ E, 52 m, 1 dd (paratype). — Stn 569, 22°49′ S, 166°59′ E, 62 m, 1 dd (paratype).
MUSORSTOM 4: stn DW 204, 22°37′ S, 167°06′ E, 120 m, 1 dd.

DISTRIBUTION (Fig. 154). — Lagoons of southern New Caledonia, 30-128 m, living at 50-82 m.

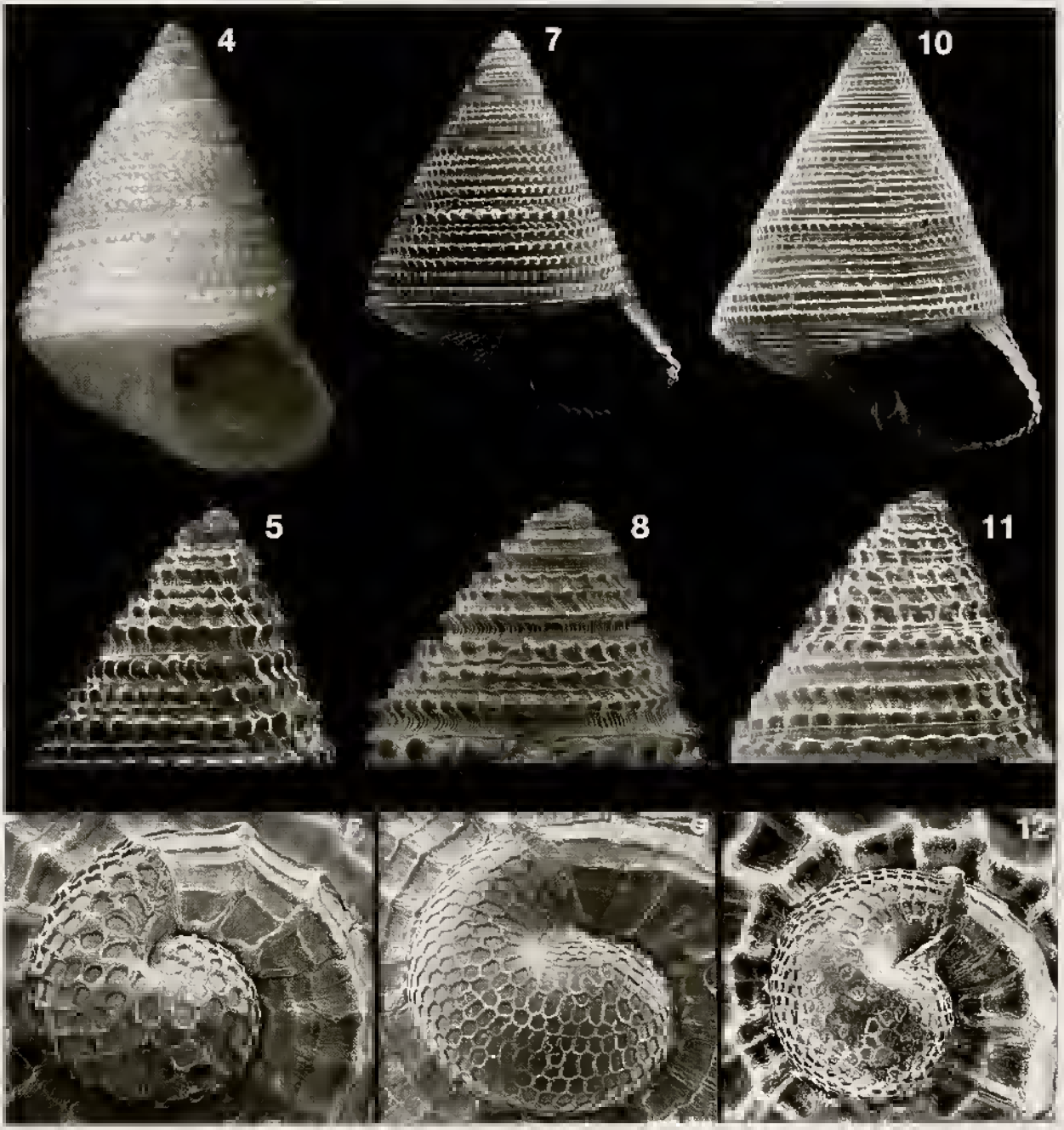
DESCRIPTION. — *Shell* up to 17.3 mm high, glossy, of moderate thickness; spire narrowly and rather evenly conical, 2.26-3.02x higher than aperture; mean spire angle 45-55°, anomphalous.

Colour of protoconch apical fold tip yellowish brown, elsewhere white. Teleoconch white or pale buff, pale green nacreous layer showing through translucent outer layer. After 3rd or 4th whorl spire with narrow, pale yellowish brown axial maculations, spiral cords on spire and base spotted with pale yellowish brown between nodules.

Protoconch 330-370 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces. Apical fold tip tapered, terminal varix strong, rounded.

Teleoconch of up to 9.75 whorls; conspicuous growth scar immediately after protoconch. First whorl convex, next whorl becoming almost flat, subsequent whorls very weakly convex with almost flush suture; periphery angulate, becoming tightly rounded on last adult whorl, S3 and P4 peripheral; base weakly convex. Spire and base with prominent, rounded spiral cords that multiply by intercalation; axial riblets strong

Source : MNHN, Paris



FIGS 4-12. — Genus *Calliostoma*, subgenus *Fautor*. — **4**, *Calliostoma (Fautor) comptum*, lectotype BMNH, 11, 1 × 7, 90 mm. **5-6**, *C. (Fautor) comptum*, off Twofold Bay, New South Wales, 15 m, NMNZ M262482, 5 × 14, 6 × 92. — **7**, *C. (F.) boucheti*, holotype, 13.0 × 10.6 mm. **8-9**, *C. (F.) boucheti*, paratype, BIOCAL: stn DW 66, 8 × 21, 9 × 108. — **10-11**, *C. (F.) richeri*, holotype, 12.3 × 9.30 mm, 11 × 20. **12**, *C. (F.) richeri*, paratype, LAGON: stn 315, × 120.

on 1st 2 or 3 whorls, becoming obsolete on 3rd or 4th whorls, rounded nodules at intersections. P1-P3 commencing immediately; P1 commencing much weaker than P2 and P3, gradually enlarging to resemble them by end of 1st whorl; P4 almost entirely exposed on spire after 2nd whorl. Secondary spirals enlarging to resemble primaries, S1 commencing at start of 4th - mid 5th whorl, S2 commencing on early 3rd - early 5th whorl; S3 commencing on mid 2nd - start of 3rd whorl, becoming stronger than P4. Tertiary spire spirals commencing after 5th or 6th whorl generally 1 in each interspace, resembling primaries and secondaries on last adult whorl. Following disappearance of axial riblets, P1, S3 and P4 with rounded nodules, other spire spirals become more weakly nodular, mostly gently undulant; S3-P4 interspace about as wide as each spiral, other interspaces considerably wider than each spiral. Basal spirals numbering 11-17, weakly nodular, interspaces wider than each spiral. Fine collabral growth lines throughout, most prominent on base. Aperture

Source : MNHN, Paris

subquadrate. Outer lip thin at rim, thickened within, large adults with 4 or 5 low, rounded spiral ridges within. Inner lip thick. Parietal inductura deposited only in large adults, of moderate thickness.

Radula (Fig. 118-poor preparation from decayed animal) with 3 pairs of lateral teeth, innermost marginals with 5 or 6 cusps, otherwise similar to those of *C. (F.) comptum* and *C. (F.) boucheri*.

TABLE 2. — *Calliostoma (Fautor) richeri*. Shell measurements (mm) and countings (LAGON: stns 297, 359, 376, 400, 401).

Character	*n*	Range	Mean	SD
H	13	09.10-17.30	11.80	2.05
D	13	07.20-11.40	09.19	1.12
H/D	13	01.14-01.52	01.28	0.08
TW	13	07.30-09.75	08.07	0.63

REMARKS. — *Calliostoma (Fautor) richeri* differs from *C. (F.) comptum* and other species of subgenus *Fautor* from the New Caledonia area in having only 3 pairs of lateral teeth. The species is particularly distinctive in the combination of colour pattern, very narrowly conical spire, flattened teleoconch whorls, and the virtual obsolescence of nodules on spire spirals other than P1, S3 and P4 after the disappearance of the axial costae. *C. (F.) richeri* is the dominant calliostomatid in the lagoons of southern New Caledonia.

ETYMOLOGY. — Named after Bertrand RICHER DE FORGES, ORSTOM, New Caledonia.

Calliostoma (Fautor) necopinatum sp. nov.

Figs 31-33, 121, 155; Table 3

TYPE MATERIAL. — Holotype (10.2 × 8.00 mm, 6.75 TW) MNHN. Paratypes: 12 MNHN, 1 AMS C201703, 1 BMNH 1995.015, 1 NMNZ M262468, 1 NMP, 1 USNM.

TYPE LOCALITY. — N. New Caledonia, MUSORSTOM 4, stn DW 164, 18°33′ S, 163°13′ E, 255 m.

MATERIAL EXAMINED. — All type material. **New Caledonia**. MUSORSTOM 4: stn DW 164, 18°33′ S, 163°13′ E, 255 m, 7 lv (holotype and 6 paratypes).
LAGON: stn 444, 18°15′ S, 162°59′ E, 300-350 m, 11 lv (paratypes: 1 AMS, 1 BMNH, 6 MNHN, 1 NMNZ, 1 NMP, 1 USNM).

DISTRIBUTION (Fig. 155). — Off d'Entrecasteaux Reefs, northern New Caledonia, 255-350 m, living at 300-350 m.

DESCRIPTION. — *Shell* up to 12.6 mm high, stout, glossy; spire narrowly conical, very weakly cyrtoconoid, 1.92-2.06x higher than aperture; mean spire angle 57-61°, anomphalous.

Colour of apical fold tip yellowish brown, rest of protoconch and 1st 1 or 2 teleoconch whorls white. Subsequent spiral whorls buff white, yellowish brown axial maculations or small scattered spots on 2nd - 4th or 3rd and 4th whorls, peripheral spots only on 1 or more later whorls in heavily pigmented specimens. Base white.

Protoconch 400-420 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces. Apical fold tip tightly rounded, terminal varix rounded.

Teleoconch of up to 7.20 whorls; 1st quarter whorl with 4 crisp spiral threads, delineated by growth scar. First 2 whorls convex, subsequent whorls very weakly convex with weakly impressed suture; periphery angulate, becoming rounded at maturity; base weakly convex. Spire and basal spirals prominent, rounded, multiplying by intercalation, with rounded conical nodules, interspaces about as wide as each spiral; axial riblets strong on 1st 2 whorls, becoming obsolete on 3rd whorl. P1-P4 commencing immediately after post larval growth scar. P1 weak at first, gradually enlarging to resemble similar P2 and P3 by end of 2nd whorl; P4 partly covered by succeeding whorls. Secondary spirals enlarging to resemble primaries, S1 commencing early 3rd - early 4th whorl; S2 commencing late 2nd - mid 3rd whorl, S3 commencing early - late 4th whorl. Earliest tertiary spiral commencing between P1 and S1 on or near 6th whorl, enlarging to resemble adjacent spirals in some adults, a single spiral in most other interspaces on last adult whorl. Base with 12-15 spiral cords, stronger and more strongly nodular over inner half. Numerous fine spiral threads on 1st 2 whorls; raised collabral

Source : MNHN, Paris

growth lines throughout, prominent in P3-P4 interspace before appearance of S3. Aperture subquadrate. Outer lip thin at rim, thickened within, strongly so on abapical side. Inner lip thick. Parietal lip extremely thin.

Radula (Fig. 121 - from dried animal) with 5 pairs of lateral teeth, innermost marginal with 5 or 6 stout cusps. Radula and jaws otherwise as in *C. (F.) boucheti*.

TABLE 3. — *Calliostoma (Fautor) necopinatum*. Shell measurements (mm) and countings (LAGON: stn 444, MUSORSTOM 4: stn DW 164).

Character	*n*	Range	Mean	SD
H	10	9.80-12.60	10.76	0.91
D	10	8.00-10.00	08.55	0.65
H/D	10	1.16-01.31	01.25	0.04
TW	10	6.40-07.20	06.78	0.28

REMARKS. — *Calliostoma (Fautor) necopinatum* is superficially similar to broad forms of the southern Australian species *C. (F.) comptum* in gross facies but in fact it differs in numerous details, most notably the smaller, more finely sculptured protoconch (diameter 400-420 µm instead of 500-530 µm) and finer nodules. Among previously described species, *C. (F.) necopinatum* seems to be most closely related to *C. simplex* Schepman, 1908 (Banda Sea, 304 m - holotype ZMA), differing in having a colour pattern on the early teleoconch, in the earlier appearance of S1 (early 3rd - 4th whorl instead of late 5th whorl), in having somewhat finer spiral cords and nodules on the spire, and, in having 12-14 instead of 10 more closely spaced spiral cords on the base. The largest mature specimens of *C. (F.) necopinatum* are smaller than the holotype of *C. simplex* (height 12.6 vs. 14.3), and their peripheries become rounded about one full whorl earlier.

ETYMOLOGY. — Unexpected (Latin).

Calliostoma (Fautor) paradigmatum sp. nov.

Figs 13-15, 119, 155; Table 4

TYPE MATERIAL. — Holotype (11.4 × 10.0 mm, 6.75 TW) MNHN. Paratypes: 11 MNHN, 1 AMS C201704, 1 NMNZ M262465, 1 NMP, 1 USNM.

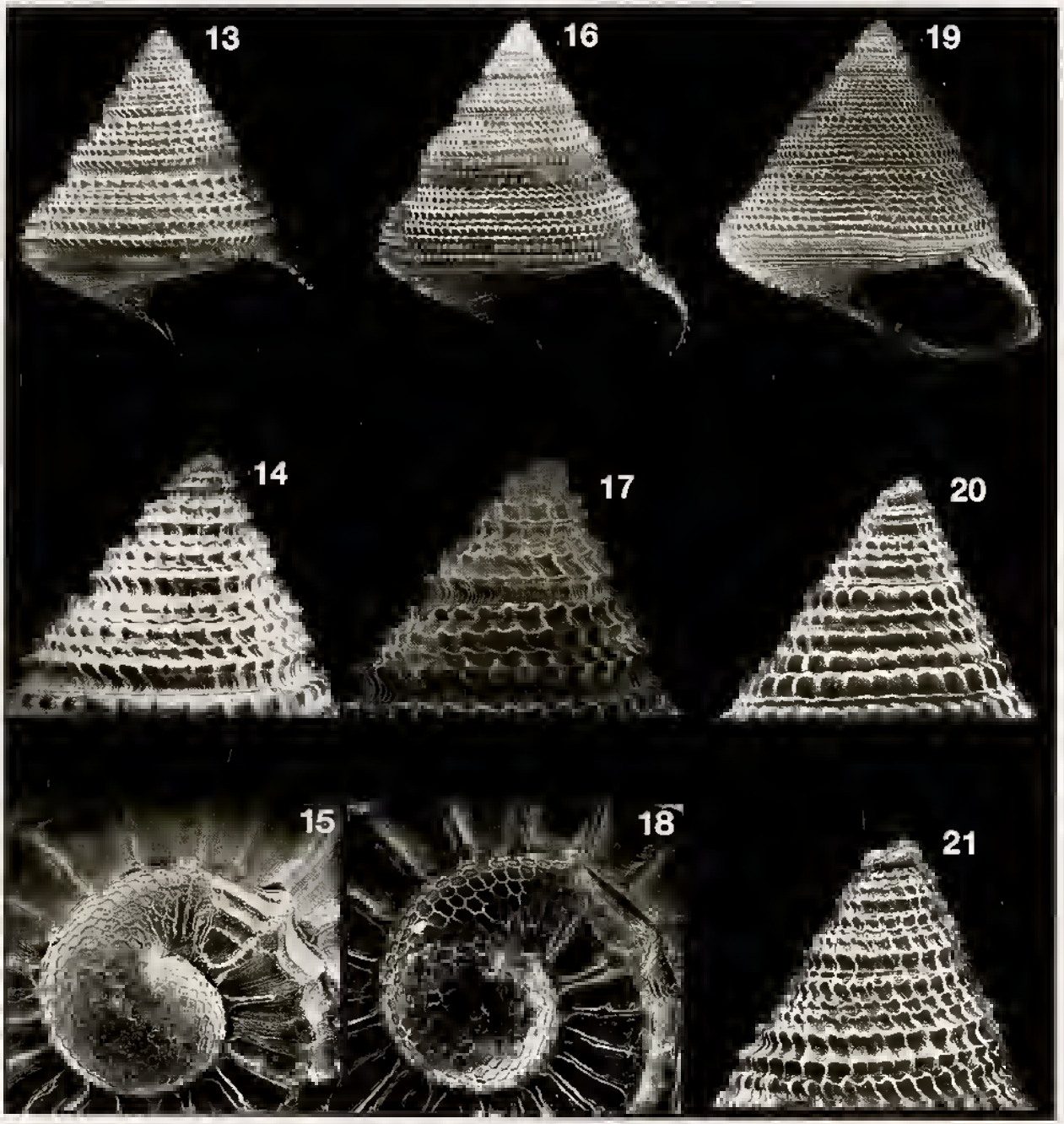
TYPE LOCALITY. — S. New Caledonia, MUSORSTOM 4, DW 220, 22°58' S, 167°38' E, 505-550 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 159, 18°46' S, 163°16' E, 585 m, 1 lv. — Stn DW 220, 22°58' S, 167°38' E, 505-550 m, 5 lv (holotype and paratypes: 2 MNHN, 1 AMS, 1 NMNZ).
CHALCAL 2: stn DW 76, 23°41' S, 167°45' E, 470 m, 2 dd (paratypes).
BIOCAL: stn DW 33, 23°10' S, 167°10' E, 675-680 m, 1 dd (paratype). — Stn DW 36, 23°09' S, 167°11' E, 650-680 m, 2 dd (paratypes). — Stn CP 40, 22°55' S, 167°24' E, 650 m, 1 dd (paratype). — Stn DW 51, 23°05' S, 167°45' E, 680-700 m, 5 lv (paratypes: 3 MNHN, 1 NMP, 1 USNM).

DISTRIBUTION (Fig. 155). — Off Ile Surprise, northern New Caledonia (alive at 585 m), and south of Ile des Pins, southern New Caledonia, 470-775 m, living at 505-700 m.

DESCRIPTION. — *Shell* up to 13.9 mm high, glossy, of moderate thickness; spire rather broadly and evenly conical, 1.55-1.65x higher than aperture, mean spire angle 31-35°, anomphalous.
Colour: Uniform white, pale pink and green nacreous layer showing through translucent outer layer in spiral interspaces.
Protoconch 400-430 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces. Apical fold lip rounded, terminal varix strong, rounded.

Source : MNHN, Paris



FIGS 13-21. — Genus *Calliostoma*, subgenera *Fautor*, *Calliostoma* and *Ampullotrochus*. — **13-14**, *Calliostoma (Fautor) paradigmatum*, holotype, 11.4 × 10.0 mm, 14 × 13. — **15**, *C. (F.) paradigmatum*, paratype, BIOCAL: stn DW 51, × 96. — **16-17**, *C. (F.) metivieri*, holotype, 11.5 × 9.40 mm, 17 × 20. — **18**, *C. (F.) metivieri*, paratype, CHALCAL 2: stn DW 76, × 116. — **19**, *C. (F.)* sp. cf. *metivieri*, CHALCAL 2: stn DW 74. — **20**, *C. (C.) zizyphinum*, Calvi, Corsica (Swedish Museum of Natural History, Stockholm), × 16. — **21**, *C. (Ampullotrochus) granulatum*, Benicarlo, Spain. NMNZ M237686, × 18.

Teleoconch of up to 7.60 whorls; 1st eighth whorl with crisp spiral threads, delineated by growth scar. First 3 whorls convex, subsequent whorls weakly convex, suture well impressed; periphery angulate, becoming rounded at maturity, P3 peripheral; base weakly convex. Spire and basal spirals rounded, multiplying by intercalation; nodules roundly conical on spire, bluntly rounded on base; axial costae strong on 1st 3 whorls, weakening on 4th whorl, obsolete on subsequent whorls. P2-P4 commencing immediately, P2 and P3 strong and similar throughout, P4 partly covered by succeeding whorls, P1 commencing mid 2nd - early 3rd whorl, as large as P2 and P3 on 4th and later whorls. S1 and S2 becoming as large as primaries, S1 commencing early - late 4th whorl, S2 commencing early 3rd - early 4th whorl; S3 commencing

Source : MNHN, Paris

mid 6th - mid 7th whorl, remaining weaker than others, occasionally absent. Tertiary spirals commencing on last adult whorl, 1 per interspace. Base with 12-17 spiral cords, inner 3 nodular, others becoming nodular on last adult whorl. Fine collabral growth lines throughout. Aperture subquadrate. Outer lip thin at rim, modestly thickened within. Inner lip of moderate thickness. Parietal glaze very thin, translucent.

Animal (MUSORSTOM 4: stn DW 159) creamy white. Snout tip laterally expanded, fringed with slender papillae. Cephalic tentacles tapered, finely papillate, prominent eye stalks at bases. Neck lobes well developed, thin, left considerably larger, 3 right and 4 left tapered epipodial tentacles.

Jaw plates with broadly rounded anterior edges, fringing elements short.

Radula (Fig. 119) of adult with 6 pairs of similar lateral teeth, innermost pair of marginals with 5 or 6 stout cusps, otherwise as in *C. (F.) boucheti*.

TABLE 4. — *Calliostoma (Fautor) paradigmatum*. Shell measurements (mm) and countings (BIOCAL: stns DW 36, DW 51, CHALCAL 2: stn DW 76, MUSORSTOM 4: stn DW 220).

Character	*n*	Range	Mean	SD
H	9	8.90-13.90	10.72	1.52
D	9	8.10-11.40	09.53	1.00
H/D	9	1.06-01.22	01.12	0.05
TW	9	6.00-07.60	06.48	0.51

REMARKS. — *Calliostoma (Fautor) paradigmatum* is readily separable from the somewhat similar *C. (F.) necopinatum* sp. nov. by the lack of a colour pattern and the broader spire angle. It differs further from this and from other calliostomatids in numerous details of shell morphology. The single specimen from northern New Caledonia (MUSORSTOM 4: stn DW 159) differs from southern specimens in the earlier appearance (early 5th instead of 6th - mid 7th whorl) and stronger development of S3. Although they appear to be otherwise indistinguishable, in the absence of material from geographically intermediate localities it is impossible to ascertain the status of the northern form, the characters of which were therefore excluded from the shell description.

ETYMOLOGY. — The name alludes to the rather generalised shell morphology of the species (Latin).

Calliostoma (Fautor) metivieri sp. nov.

Colour Plate; Figs 16-18, 120, 153; Table 5

TYPE MATERIAL. — Holotype (11.5 × 9.40 mm, 7.00 TW) MNHN. Paratypes: 23 MNHN, 1 AMS 201705, 1 BMNH 1995.016, 2 NMNZ M262464, M262469, 1 NMP, 1 USNM.

TYPE LOCALITY. — S. New Caledonia, SMIB 4, stn DW 65, 22°55′ S, 167°15′ E, S, 400-420 m.

MATERIAL EXAMINED. — All type material. **New Caledonia**. SMIB 1: stn DW 2, 22°52′ S, 167°13′ E, 415 m, 4 lv (paratypes: 1 AMS, 1 BMNH, 2 MNHN).
SMIB 2: stn DW 3, 22°56′ S, 167°15′ E, alive, 412-428 m, 4 lv (paratypes: 3 MNHN, 1 NMP). — Stn DW 5, 22°56′ S, 167°14′ E, 398-410 m, 2 dd (paratypes). — Stn DW 8, 22°54′ S, 16°13′ E, 435-447 m, 1 lv (paratype). — Stn DW 16, 22°51′ S, 167°12′ E, 390 m, 1 dd (paratype).
SMIB 3: stn DW 12, 23°38′ S, 167°42′ E, 470 m, 2 lv (paratypes). — Stn DW 13, 23°38′ S, 167°42′ E, 448 m, 1 lv (paratype). — Stn DW 24, 22°59′ S, 167°21′ E, 535 m, 2 lv (paratypes).
SMIB 4: stn DW 65, 22°55′ S, 167°15′ E, 400-420 m, 1 lv (holotype).
MUSORSTOM 4: stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 3 dd (paratypes).
CHALCAL 2: stn DW 76, 23°41′ S, 167°45′ E, 470 m, 5 lv (paratypes: 3 MNHN, 1 NMNZ, 1 USNM). — Stn DW 77, 23°38′ S, 167°43′ E, 435 m, 1 lv (paratype).

Source : MNHN, Paris

BIOCAL: stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 3 lv (paratypes: 2 MNHN, 1 NMNZ).

DISTRIBUTION (Fig. 154). — South of Ile des Pins, southern New Caledonia, 390-535 m, living at 400-535 m.

DESCRIPTION. — *Shell* up to 12.3 mm high, of moderate thickness, stout, glossy; spire narrowly and rather evenly conical, 1.68-2.05 × higher than aperture, mean spire angle 62-66°, anomphalous.

Colour of protoconch and 1st teleoconch whorl yellowish brown, next 2 whorls translucent white; subsequent spire whorls with irregular yellowish brown maculations, or yellowish brown with scattered white patches, pale green nacreous layer showing through translucent outer shell layer in spiral interspaces; irregular, wavy, yellowish brown axial bands extending from S3 onto outer two thirds or occasionally all of base, elsewhere white base.

Protoconch 400-420 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces. Apical fold tip rounded, terminal varix rounded.

Teleoconch of up to 7.75 whorls; 1st eighth whorl with crisp spiral threads, delineated by growth scar and strong, rounded varix. First 2 whorls strongly convex, subsequent whorls weakly convex, periphery rounded, base weakly convex, suture well impressed. Spire and basal spirals prominent, rounded, multiplying by intercalation, rounded conical nodules on spire, rounded nodules on base; interspaces about as wide as each spiral; axial riblets strong on 1st 3 whorls, becoming obsolete over next 2 whorls. P2-P4 commencing immediately after post larval growth scar; P2 and P3 similar throughout, P4 weaker; P1 commencing late 2nd or early 3rd whorl, enlarging to resemble P2 and P3; P4 partly covered by succeeding whorls, Secondary spirals enlarging to resemble primaries, S1 commencing early 4th - early 5th whorl, S2 commencing mid 3rd - mid 4th whorl, S3 commencing late 4th - late 5th whorl. Tertiary spirals commencing on last 1 or 2 whorls in adults, 1 in each of most interspaces. Base with 12-15 spiral cords, inner 3 or 4 spirals becoming nodular only on last whorl in adults. Fine collabral growth lines throughout. Aperture subquadrate. Outer lip thin at rim, thickened within, strongly so at base, inner lip thick. Parietal inductura extremely thin or absent.

Animal unknown (material dried).

Radula (Fig. 120) and jaws similar to that of *C. (F.) boucheti* sp. nov., 6 pairs of lateral teeth, innermost marginal teeth with 4 or 5 stout cusps.

TABLE 5. — *Calliostoma (Fautor) metivieri*. Shell measurements (mm) and countings (BIOCAL: stn DW 44, CHALCAL 2: stn DW 76, SMIB 1: stn DW 2, SMIB 2: stns DW 5, DW 16, SMIB 3: stns DW 13, SMIB 4: stn DW 65).

Character	*n*	Range	Mean	SD
H	14	9.10-12.30	10.73	0.98
D	14	7.70-10.20	09.00	0.80
H/D	14	1.14-01.34	01.19	0.05
TW	14	6.60-07.75	07.01	0.31

REMARKS. — *Calliostoma (Fautor) metivieri* superficially resembles *C. (F.) necopinatum* sp. nov. but differs in numerous details of shell morphology, more conspicuously the colour and colour pattern, and in being more finely sculptured. It differs from *C. (F.) paradigmatum* in having a colour pattern, finer nodules on the spire, and in that S3 appears earlier and enlarges to resemble the other primary spirals.

A single specimen taken alive from a seamount to the south east of New Caledonia (CHALCAL 2: stn DW 74, 24°40′ S, 168°38′ E, 650 m; Fig. 19) differs from the type (described) material in being uniform pale yellowish brown and in that S3 commences early on the 3rd teleoconch whorl instead of on the late 4th or 5th whorl. Additional material will be required to ascertain whether it represents a phenotypic variant, a local form of *C. (F.) metivieri*, or a distinct species.

The gut of the holotype contained much indeterminate detrital material and a few monaxonic and tetraxonic sponge spicules.

ETYMOLOGY. — Named after Bernard MÉTIVIER (MNHN).

Source : MNHN, Paris

Calliostoma (Fautor) houbricki sp. nov.

Colour Plate; Figs 22-24, 122, 156; Table 6

TYPE MATERIAL. — Holotype (12.8 × 10.8 mm, 8.30 TW) MNHN. Paratypes: 12 MNHN, 1 NMNZ M262466.

TYPE LOCALITY. — S. New Caledonia, SMIB 5, stn DW 81, 22°38′ S, 167°35′ E, 110 m.

MATERIAL EXAMINED. — All type material. **New Caledonia**. LAGON: stn 598, 22°19′ S, 167°06′ E, 73-75 m, 1 dd (paratype). — Stn 603, 22°16′ S, 167°05′ E, 78-80 m, 1 dd (paratype). — Stn 830, 20°49′ S, 165°19′ E, 105-110 m, 2 dd (paratypes). — Stn 933, 20°45′ S, 164°15′ E, 90-100 m, 2 dd (paratypes).
MUSORSTOM 4: stn DW 203, 22°36′ S, 167°05′ E, 105-110 m, 1 dd (paratype). — Stn DW 204, 22°37′ S, 167°06′ E, 120 m, 1 dd (paratype).
CHALCAL 2: stn DW 84, 23°24′ S, 168°07′ E, 170 m, 1 dd (paratype).
SMIB 5: stn DW 81, 22°38′ S, 167°35′ E, 110 m, 4 lv (holotype and paratypes: 2 MNHN, 1 NMNZ). — Stn DW 82, 22°32′ S, 167°32′ E, 155 m, 1 dd (paratype).

DISTRIBUTION (Fig. 156). — Off northern and southern New Caledonia, 73-170 m, living at 110 m.

DESCRIPTION. — *Shell* up to 12.8 mm high, glossy, stout, spire narrowly and rather evenly conical, 1.90-2.00x as high as aperture, mean spire angle 53-57°, anomphalous.

Colour: Protoconch and 1st teleoconch whorl white, subsequent whorls white or pale buff with irregular yellowish brown axial maculations; all or most spiral interspaces on spire and base other than S3-P4 interspace each with narrow yellowish brown line that is either continuous or paler or locally absent between maculations on spire.

Protoconch 350-370 μm wide, sculptured with network of fine crisp threads that enclose roughly hexagonal spaces, apical fold tip rounded, terminal varix strong.

Teleoconch of up to 8.30 whorls, a conspicuous growth scar immediately following protoconch. First whorl convex, subsequent whorls almost flat, suture essentially flush, periphery angulated at S3, base weakly convex. Spiral cords on spire and base prominent, multiplying by intercalation; axial costae strong on 1st 3 whorls, obsolete on subsequent whorls though persisting rather strongly on base. P1-P4 commencing immediately after post larval growth scar; P1 weak on 1st half whorl, rapidly enlarging to resemble P2 and P3, which are strong and similar throughout; P4 weaker, partly covered by succeeding whorls. Secondary spirals enlarging to resemble primaries; S1 commencing mid 5th - late 6th whorl; S2 absent; S3 commencing late 2nd - very early 3rd whorl, becoming stronger than primaries. Tertiary spirals commencing on last adult whorl, 1 per interspace. Nodules roundly conical on spire; smaller, low and rounded on base. Base with 8-11 rounded, similar spiral cords. Aperture subquadrate. Outer lip thin at rim, thickened within. Inner lip thick. Parietal inductura very thin.

Radula (Fig. 122) with 4 pairs of lateral teeth, similar to that of *C. (F.) boucheti*.

Jaws typical of subgenus *Fautor*.

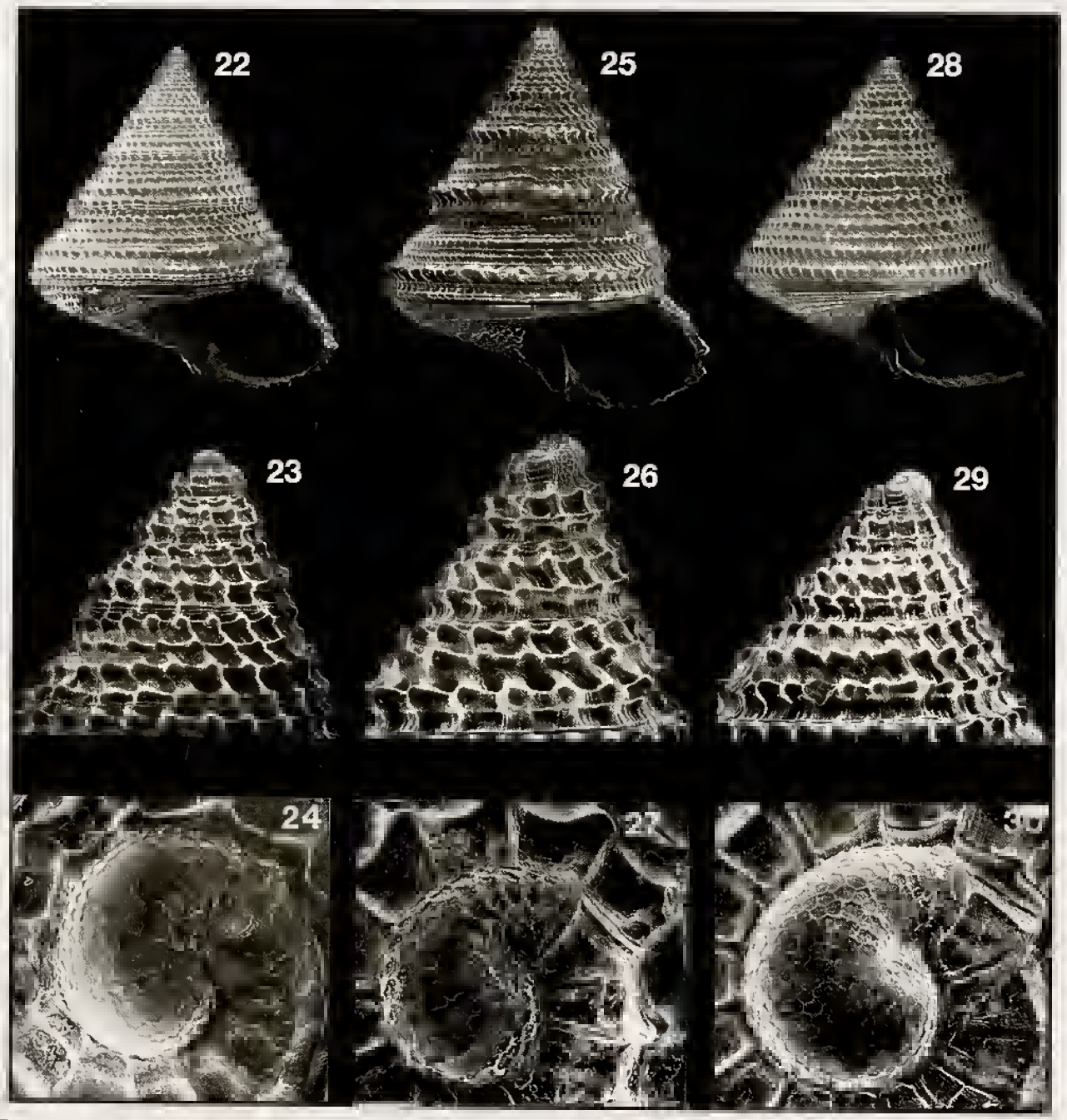
TABLE 6. — *Calliostoma (Fautor) houbricki*. Shell measurements (mm) and counting (CHALCAL 2: stn DW 84, MUSORSTOM 4: stns DW 203, DW 204, SMIB 5: stn DW 81).

	n	Range	Mean	SD
H	7	8.50-12.80	9.71	1.60
D	7	7.30-10.80	8.28	1.24
H/D	7	1.11-01.23	1.17	0.03
TW	7	7.25-08.30	7.69	0.38

REMARKS. — *Calliostoma (Fautor) houbricki* closely resembles *C. (F.) scobinatum* (A. Adams *in* REEVE, 1863) from Bombay, India, in shape, sculpture, size relative to the number of whorls, colour, and colour pattern. The New Caledonian species differs in having a slightly broader protoconch (width 350-370 μm instead of 300 μm), stronger nodules on the spire with S3 more prominent, and in lacking the strong spiral ridges within the aperture at maturity.

The two syntype lots of *C. (F.) scobinatum* (BMNH 1968827, 1968828) together comprise three

Source : MNHN, Paris



FIGS 22-30. — Genus *Calliostoma*, subgenus *Fautor*. — **22-24**, *Calliostoma (Fautor) houbricki*, holotype, 12.8 × 10.8 mm, 23 × 24, 24 × 136. — **25**, *C. (F.) periglyptum*, holotype, 10.2 × 8.30 mm. — **26-27**, *C. (F.) periglyptum*, paratype, CHALCAL 2: stn CP 18, 26 × 32, 27 × 112. — **28-30**, *C. (F.) chesterfieldense*, holotype, 7.60 × 6.90 mm, 29 × 24, 30 × 108.

specimens of *C. scobinatum* and four specimens of *C. duplicatum* (A. Adams, 1851). The specimen here chosen as lectotype (BMNH 1968827/1, 15.5 × 11.8 mm, 9.00 TW) agrees most closely with the original description and illustration (ADAMS *in* REEVE 1863: pl. 5, Fig. 29). An example of *C. duplicatum* from the same lot was interpreted as a "rounded form of *Z. scobinatus*" by REEVE (1863: pl. 5, Fig. 34). Compared with *C. scobinatum*, *C. duplicatum* differs in having stronger sculpture on

Source : MNHN, Paris

the spire, in having a rounded periphery at maturity and in lacking S3, among other differences. *C. duplicatum* is herein referred to *Dactylastele* gen. nov. A single syntype of *C. quadricolor* Schepman, 1908 (ZMA, *"Siboga"* stn 49a, Sape Strait, Lesser Sunda Is, Indonesia, 69 m) is extremely similar to *C. scobinatum* in shell morphology and, although leached due to prolonged storage in acidic alcohol, clearly shows fine yellowish brown spiral lines in the spiral interspaces as in *C. scobinatum* and *C. houbricki*. It differs from both of the latter species, however, in that the prosocline axial costae on the early teleoconch are more crisply defined and persistent, and distinctly opisthocyrt instead of almost straight. SCHEPMAN's (1908: 65) statement that the spire is "purplish at the top" is discordant also, although this colour is not evident in the bleached syntype. The syntype is clearly not the specimen illustrated or measured by SCHEPMAN (1908: 65, pl. 5, fig. 7; "alt 8 1/2, diam. maj. 7" mm, vs. 6.65 × 6.05 mm), which must therefore have been based upon the second specimen from *"Siboga"* stn 257. It is highly likely that the extant syntype is a distinct species. Unfortunately the originally illustrated specimen cannot be traced at ZMA (MOOLENBEEK pers. comm.). Although *C. scobinatum*, *C. houbricki*, and the extant syntype of *C. quadricolor* are undoubtedly closely related, it will be impossible to ascertain their precise status with respect to one another until better, preferably topotypic, specimens of *C. quadricolor* are available for comparison.

Among other calliostomatids from the region presently under study, *C. houbricki* is well characterised by its highly distinctive colour pattern. *"Calliostoma" poupineli* (see below) has a somewhat similar colour pattern but differs widely in shell and radular morphology.

ETYMOLOGY. — Named after Richard ('Joe') HOUBRICK (USNM).

Calliostoma (Fautor) periglyptum sp. nov.

Figs 25-27, 123, 157; Table 7

TYPE MATERIAL. — Holotype (10.2 × 8.30 mm, 7.50 TW) MNHN. Paratypes: 13 MNHN, 1 AMS C201706, 1 NMNZ M262472.

TYPE LOCALITY. — S. New Caledonia, CHALCAL 2, stn DW 71, 24°42′ S, 168°10′ E, S, 230 m.

MATERIAL EXAMINED. — All type material. **New Caledonia**. BIOCAL: stn DW 64, 24°48′ S, 168°09′ E, 250 m, 3 dd (paratypes).
CHALCAL 2: stn CP 18, 24°47′ S, 168°09′ E, 274 m, 2 dd (paratypes: 1 AMS, 1 MNHN). — Stn CP 20, 24°45′ S, 168°09′ E, 230 m, 1 lv (paratype). — Stn DW 71, 24°42′ S, 168°10′ E, 230 m, 4 lv (holotype and paratypes).
Loyalty Islands. MUSORSTOM 6: stn DW 399, 20°42′ S, 167°00′ E, 282 m, 2 dd (paratypes). — Stn DC 402, 20°30′ S, 166°49′ E, 520 m, 1 dd (paratype). — Stn DW 417, 20°42′ S, 167°04′ E, 283 m, 1 dd (paratype). — Stn DW 423, 20°26′ S, 166°41′ E, 280 m, 2 dd (paratypes: 1 MNHN, 1 NMNZ).

DISTRIBUTION (Fig. 157). — Off Lifou, Loyalty Islands, and south of New Caledonia, 230-520 m, living at 230 m.

DESCRIPTION. — *Shell* up to 10.2 mm high, glossy, stout, spire narrowly and rather evenly conical, 2.13-2.44x as high as aperture, mean spire angle 43-53°, anomphalous.

Colour of apical fold tip and suture on 1st teleoconch whorl brown, protoconch elsewhere white. Teleoconch pale yellowish brown with small, scattered, irregular, yellowish brown and white patches, P4 usually alternately streaked yellowish brown and white. Base either translucent white, or pale yellowish brown with yellowish brown streaks on some or all major spiral cords.

Protoconch 330-380 µm wide, sculptured with network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip tightly rounded, terminal varix strong.

Teleoconch of up to 7.60 whorls: 1st quarter whorl with crisp spiral threads, delineated by strong, rounded varix and growth scar. First 2.5 whorls convex, subsequent whorls weakly convex, angulated at peripheral P3, suture weakly impressed; base sharply contracted below P4, weakly convex, periphery tightly rounded on last adult whorl. Spiral cords on spire and base prominent, multiplying by intercalation; axial costae strong on 1st 4 whorls, weakening on 5th whorl, almost obsolete on subsequent whorls though persisting

Source : MNHN, Paris

rather strongly between P3 and P4, traversing base in adults, P2-P4 commencing immediately after post larval scar; P2 and P3 strong throughout, similar on 1st 2 whorls, P3 considerably stronger after 3rd whorl; P1 commencing at start of 2nd whorl, enlarging to resemble P2; P4 partly covered by succeeding whorls. Secondary spirals remaining weaker than primaries, S1 commencing mid 5th - mid 7th whorl, S2 commencing early - mid 4th whorl, S3 (when present) commencing end 5th - start of 8th whorl. Tertiary spirals commencing about mid 6th whorl, 1 per interspace. Nodules on spire roundly conical, strongest and sharpest on P3, basal nodules low, rounded. Base with 10-14 similar, rounded spiral cords, inner 3 nodular and others smooth in immaturity, all nodular on last whorl in adults. Fine collabral growth lines throughout. Aperture subcircular. Outer lip thin at rim, thickened within, strongly so abapically. Inner lip thick. Parietal inductura extremely thin, translucent.

Animal unknown (material dried).

Radula (Fig. 123) and jaws similar to those in *C. (F.) boucheti* sp. nov., 5 pairs of lateral teeth, innermost marginals with 4 or 5 stout cusps.

TABLE 7. — *Calliostoma (Fautor) periglyptum*. Shell measurements (mm) and countings (CHALCAL 2: stns CP 18, CP 20, DW 71, MUSORSTOM 6: stns DW 399, DW 423).

Character	*n*	Range	Mean	SD
H	10	6.90-10.20	8.24	0.95
D	10	5.90-08.30	6.73	0.66
H/D	10	1.12-01.35	1.22	0.06
TW	10	6.50-07.60	7.06	0.37

REMARKS. — *Calliostoma (Fautor) periglyptum* is rendered highly distinctive by the combination of small size, narrowly conical spire, and very prominent nodules on P3. *C. (F.) scobinatum* (Adams *in* REEVE, 1863) is similar in shape but differs markedly in having narrow spiral colour bands between the spiral cords, and in numerous details of teleoconch sculpture. The gut contents are white and comprise many very fine irregular particles and foram tests.

ETYMOLOGY. — Carved around (Greek).

Calliostoma (Fautor) chesterfieldense sp. nov.

Colour Plate; Figs 28-30, 124, 154; Table 8

TYPE MATERIAL. — Holotype MNHN. Paratypes: 5 MNHN, 1 NMNZ M262471.

TYPE LOCALITY. — Off Chesterfield Islands, MUSORSTOM 5, stn 379, 19°53′ S, 158°40′ E, 370-400 m.

MATERIAL EXAMINED. — All type material. **Chesterfield Islands**. MUSORSTOM 5: stn 339, 19°53′ S, 158°38′ E, 380-395 m, 1 lv (paratype). — Stn 362, 19°53′ S, 158°40′ E, 410 m, 1 lv (paratype). — Stn 378, 19°54′ S, 158°38′ E, 355 m, 1 dd (paratype). — Stn 379, 19°53′ S, 158°40′ E, 370-400 m, 4 lv (holotype and paratypes: 2 MNHN, 1 NMNZ).

DISTRIBUTION (Fig. 153). — Off Chesterfield Islands, 355-410 m, living at 370-410 m.

DESCRIPTION. — *Shell* up to 9.30 mm high, glossy, stout. Spire evenly conical, 1.50-1.69x as high as aperture, mean spire angle 60-64°, anomphalous.

Colour of apical fold tip yellowish brown, rest of protoconch and 1st teleoconch whorl pale yellowish brown; subsequent whorls buff white or pale yellowish brown; P2 with small, widely spaced yellowish brown spots, white after each spot then grading to ground colour before next spot; S3 and P4 white, with small yellowish brown spots; basal spirals spotted yellowish brown.

Protoconch 430-450 µm wide sculptured with network of fine crisp threads that enclose roughly hexagonal spaces, apical fold tip rounded, terminal varix strong.

Teleoconch of up to 6.30 whorls, 1st eighth whorl with fine spiral threads, delineated by pronounced growth scar. First 2 whorls convex, next whorl becoming weakly convex, subsequent whorls almost flat, suture essentially flush; periphery angulated at S2 and P4, end of last adult whorl becoming tightly rounded; base weakly convex. Spiral cords on spire and base prominent, multiplying by intercalation; axial costae strong on 1st 3 whorls, weaker or almost obsolete on subsequent whorls. P2-P4 commencing immediately after

Source : MNHN, Paris

post larval scar; P2 and P3 strong and similar in size throughout; P1 commencing late on 1st whorl, rapidly enlarging to resemble P2 and P3 in size: P4 weaker, partly covered by succeeding whorls. Secondary spirals enlarging to resemble adjacent primaries; S1 commencing mid 4th - mid 5th whorl; S2 commencing early 4th whorl; S3 commencing late 3rd -early 4th whorl close beside P4, usually becoming almost or entirely fused with P4. Tertiary spirals commencing on last adult whorl, 1 or more, 1 per interspace. Nodules bluntly roundly conical on spire. After 3rd whorl, 1st (white) nodule after each yellowish brown spot on P2 distinctly enlarged, following nodules decreasing in size towards next white nodule. Base with 11-13 similar, rounded spiral cords, inner 2 or 3 with low, rounded nodules; outer spirals more or less smooth, becoming nodular on last adult whorl. Fine collabral growth lines throughout. Aperture subquadrate. Outer lip thin at rim, thickened within, strongly so on abapical side. Inner lip thick. Parietal inductura extremely thin.

Animal creamy white. Tip of snout fringed with long narrow papillae. Cephalic tentacles long, narrow, tapered, finely papillate, large eyes at outer bases. Neck lobes well developed, left considerably larger. Epipodial tentacles slender, tapered, 4 on each side.

Radula (Fig. 124) and *jaws* similar to those of *C. (F.) boucheti*, 6 pairs of lateral teeth, innermost marginals with 3 or 4 stout cusps.

TABLE 8. — *Calliostoma (Fautor) chesterfieldense*. Shell measurements (mm) and countings.

H	D	H/D	TW	
4.20	4.00	1.05	4.30	MUSORSTOM 5: stn 362
7.10	6.60	1.07	5.60	MUSORSTOM 5: stn 379
7.60	6.90	1.10	5.90	Holotype
8.30	7.20	1.15	6.20	MUSORSTOM 5: stn 379
9.30	8.25	1.13	6.30	MUSORSTOM 5: stn 378

REMARKS. — *Calliostoma (Fautor) chesterfieldense* is similar to *C. (F.) metivieri* in size relative to the number of whorls and in shape, but differs, however, in numerous details, including colour and colour pattern, close proximity of S3 and P4, and the irregular-shaped nodules on P2.

ETYMOLOGY. — From Chesterfield Islands.

Calliostoma (Fautor) vanbani sp. nov.

Figs 34-36, 151, 153

TYPE MATERIAL. — Holotype (7.60 × 6.95 mm, 6.10 TW) MNHN. Paratypes: 4 MNHN, 1 NMNZ M262467.

TYPE LOCALITY. — N. New Caledonia, MUSORSTOM 4, stn DW 197, 18°51′ S, 163°21′ E, 550 m.

MATERIAL EXAMINED. — All type material. **New Caledonia**. LAGON: stn 444, 18°15′ S, 162°59′ E, 300-350 m, 1 dd (paratype). — Stn 475, 18°36′ S, 163°11′ E, 415-460 m, 1 dd (paratype). MUSORSTOM 4: stn DW 162, 18°35′ S, 163°10′ E, 525 m, 1 dd (paratype). — Stn DW 181, 18°57′ S, 163°22′ E, 350 m, 2 lv (paratypes: 1 MNHN, 1 NMNZ). — Stn DW 197, 18°51′ S, 163°21′ E, 550 m, 1 dd (holotype).

DISTRIBUTION (Fig. 154). — Off northern New Caledonia, 300-550 m, living at 350 m.

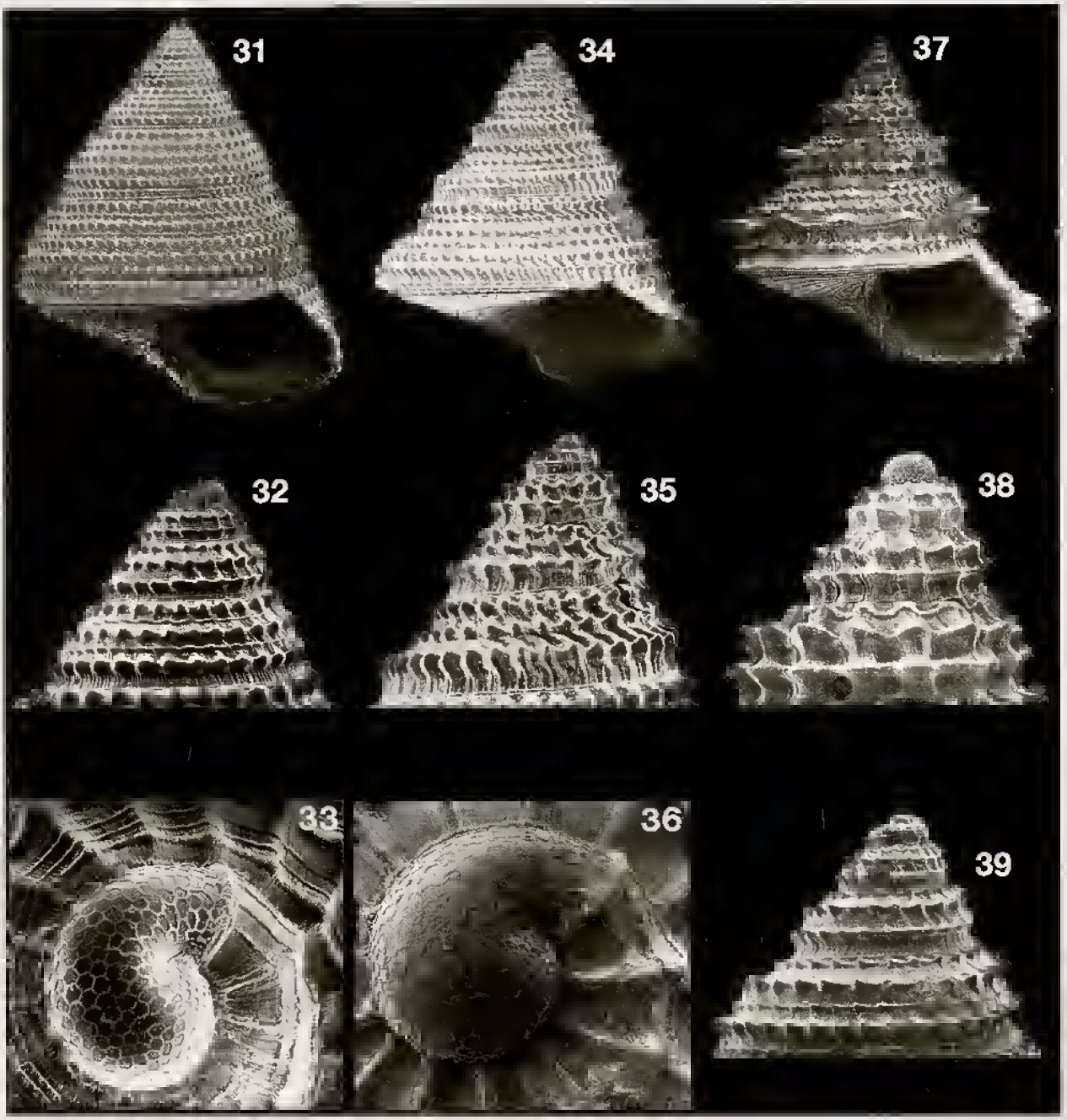
DESCRIPTION. — *Shell* up to 11.5 mm high, glossy, of moderate thickness; spire rather evenly conical, 2.25-2.38x higher than aperture; mean spire angle 55-56°, anomphalous.

Colour of protoconch yellowish brown. Teleoconch golden yellow, spirals and nodules predominantly translucent white; inner 3 basal spirals, their interspaces, and columella white.

Protoconch 400-430 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces. Apical fold tip rounded, terminal varix of moderate strength, rounded.

Teleoconch of up to 7.50 whorls; 1st eighth whorl with 4 similar spiral threads, delineated by growth scar. First 2 spire whorls convex, subsequent whorls angulated at P3 and distinctly concave between P1 and P3, last whorl flattened; suture essentially flush after 3rd whorl; periphery tightly rounded, S3 peripheral, base weakly convex. Spire and basal

Source : MNHN, Paris



FIGS 31-39. — Genus *Calliostoma*, subgenera *Fautor* and *Benthastelena*. — **31**, *Calliostoma (Fautor) necopinatum*, holotype, 10.2 × 8.00 mm. **32-33**, *C. (F.) necopinatum*, paratype, MUSORSTOM 4: stn DW 164, 32 × 18, 33 × 104. — **34-36**, *C. (F.) vaubani*, holotype, 7.60 × 6.95 mm, 35 × 19, 36 × 120. **37-38**, *C. (Benthastelena) katherina*, off Sydney, New South Wales, AMS C152388, 9.00 × 9.00 mm, 38 × 26. — **39**, *C. (B.) aculeatum*, off Mikawa, Japan, NMNZ M242243, × 18.

spirals prominent, rounded, multiplying by intercalation, with rounded conical nodules; axial riblets strong on 1st 3 whorls, weakening and becoming obsolete on 4th whorl, though persisting between P3 and P4. P2 and P3 commencing immediately after post larval growth scar, similar on 1st whorl, P3 stronger thereafter; P1 commencing early on 2nd whorl, rapidly enlarging, as large as P2 on 3rd and 4th whorls, after 4th whorl becoming as large as P3 or larger and substantially stronger than P2; P4 weakest, almost entirely covered by succeeding whorls. S1 commencing early 5th or 6th whorl, enlarging to resemble P2; S2 commencing early - mid 4th whorl, enlarging to resemble P2; S3 commencing mid 4th - early 5th whorl, becoming as large as P3. 1 or 2 tertiary spirals occasionally appear after 6th whorl. Basal spirals

Source : MNHN, Paris

numbering 11-14, inner 3 strongest, interspaces about as wide as each spiral, on 5th whorl outer 2 and inner 3 spirals nodular, others smooth until after 6th whorl. Collabral growth lines throughout, more prominent on base, on last adult whorl resolving as long, rounded axial riblets that interconnect nodules. Aperture subquadrate. Outer lip thin at rim, thicker within. Inner lip thick. Parietal inductura deposited only in large adults, very thin.

Animal white, snout lip fringed with slender papillae. Cephalic tentacles slender, tapered, finely papillate, large eyes at outer bases. Neck lobes well-developed thin, left considerably larger. Epipodial tentacles numbering 3 right and 4 left.

Radula and jaws (Fig. 151) similar to those of *C. (F.) boucheti*, 5 pairs of lateral teeth, innermost marginals with 2-4 stout cusps.

TABLE 9. — *Calliostoma (Fautor) vaubani*. Shell measurements (mm) and countings.

H	D	H/D	TW	
05.85	5.65	1.03	5.75	MUSORSTOM 4: stn DW 181
07.10	6.60	1.07	6.25	LAGON: stn 444
07.60	6.95	1.09	6.10	Holotype
08.80	7.60	1.16	7.00	MUSORSTOM 4: stn DW 181
11.50	9.60	1.20	7.50	LAGON: stn 475

REMARKS. — *Calliostoma (Fautor) vaubani* is rendered highly distinctive by being concave between P2 and P3 and angulate at P3 on all but the earliest and last teleoconch whorls, and in that P1 enlarges to a greater size than P2 after the 4th whorl.

ETYMOLOGY. — After N.O. *"Vauban"*.

Subgenus *BENTHASTELENA* Iredale, 1936

Benthastelena Iredale, 1936: 285. Type species (OD): *Benthastelena katherina* Iredale, 1936; Recent, Queensland.

Synonym:
Tristichotrochus Ikebe, 1942: 258. Type species (OD): *Calliostoma aculeatum* Sowerby, 1912; Recent, Japan (**Syn. nov.**).

REMARKS. — The type species of *Benthastelena* (Figs 37-38) and *Tristichotrochus* (Fig. 39) are essentially similar in gross shell facies, sharing convex whorls, umbilicus, thin shell, exsert protoconch, late-developing P1, relatively strong P2 and P3, high, narrow sharply angulate spiral cords, and sharply pointed nodules. Unfortunately, well preserved animals of *T. aculeatus* were unavailable to me, though isolated teeth from a decayed dry animal are very similar to those in *B. katherina*, the external anatomy, radula (Fig. 125) and jaws of which are similar to those in *Calliostoma (s. str.)* and subgenus *Fautor*. Since I am unable to find a single character or combination of character states that would justify placement of *B. katherina* and *T. aculeatus* in discrete genera or subgenera, *Tristichotrochus* is synonymised with the prior *Benthastelena*.

Benthastelena appears to be restricted to the tropical and subtropical western Pacific. Apart from the species recorded herein, typical members include the Japanese species *C. (T.) soyoae* Ikebe, 1942, as well as several undescribed species from off the Philippine Islands (NMNZ, MNHN). *Benthastelena* also seems to be an appropriate position for a second group with similar sculpture but in which P2 is not significantly enlarged, the spire is more narrowly conical with flatter whorls, and with or without a narrow umbilicus. This group includes such species as *T. tosaensis* Kuroda & Habe, 1961 (western Pacific), *C. (T.) gendalli* Marshall, 1979 (Kermadec Islands), and *C. (T.) paucicostatum* Kosuge, 1984 (Philippine Islands). As already discussed herein, adults of such typical *Benthastelena* species as *B. katherina* resemble their own juvenile stages in whorl convexity and in the relatively large size of P2 and P3.

Benthastelena is thus separated from *Calliostoma (s. str.)* (and other genus-group taxa) primarily on the basis of the high narrow, widely spaced, angulate spiral cords and the (generally)

Source : MNHN, Paris

prickly nodules on the spire whorls. In the apparent absence of other significant differences, it seems appropriate to interpret *Benthastelena* as a subgenus of *Calliostoma*.

Most species that have been referred to *Tristichotrochus* other than those already mentioned fall into three groups on the basis of distinctive shell morphology. These groups, typified by *Trochus unicus* Dunker, 1860 (Japan), *Ziziphinus haliarchus* Melvill, 1889 (Japan), and *Calliostoma formosense* E.A. Smith, 1907 (South China Sea) are each probably worthy of at least subgeneric status within *Calliostoma*, though resolution of these problems is beyond the scope of the present contribution.

Calliostoma (Benthastelena) diadematum sp. nov.

Colour Plate; Figs 40-42, 126, 154; Table 10

TYPE MATERIAL. — Holotype (11.0 × 10.5 mm, 7.25 TW) MNHN. Paratypes: 7 MNHN, 1 AMS C201707, 1 NMNZ M262463.

TYPE LOCALITY. — Chesterfield Islands, Capel Bank, MUSORSTOM 5, stn 255, 25°15' S, 159°55' E, 280-295 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn 255, Capel Bank, 25°15' S, 159°55' E, 280-295 m, 3 lv (holotype and paratypes: 1 AMS, 1 MNHN). — Stn 258, Capel Bank, 25°33' S, 159°46' E, 300 m, 2 dd (paratypes). — Stn 270, Capel Bank, 24°49' S, 159°34' E, 223 m, 1 dd (paratype). — Stn 276, Capel Bank, 24°49' S, 159°41' E, 269-258 m, 2 lv (paratypes: 1 MNHN, 1 NMNZ). — Stn 295, Argo Bank, 23°13' S, 159°32' E, 279 m, 1 dd (paratype). — Stn 298, Nova Bank, 22°44' S, 159°22' E, 320 m, 1 lv (paratype). — Stn DC 382, 19°37' S, 158°43' E, 580 m, 1 dd.
New Caledonia. MUSORSTOM 4: stn DW 204, 22°37' S, 167°06' E, 120 m, 1 dd.

DISTRIBUTION (Fig. 153). — Capel Bank (type loc.), Argo Bank, Chesterfield Islands, and off southern New Caledonia, 120-580 m, living at 258-320 m.

DESCRIPTION. — *Shell* up to 12.7 mm high, glossy, stout, spire rather broadly conical, 1.43-2.05x as high as aperture, mean spire angle 59-71°, narrowly umbilicate.

Colour of protoconch and 1st teleoconch whorl pale buff white or white; subsequent whorls pale buff white or white, irregular yellowish, brown patches on shoulder and on outer part of base extending from below P3; smaller, mostly paler spots elsewhere on spire and base; last part of last adult whorl occasionally locally flushed pale pink.

Protoconch 370-400 µm wide, sculptured with network of fine, crisp threads that enclose roughly hexagonal spaces.

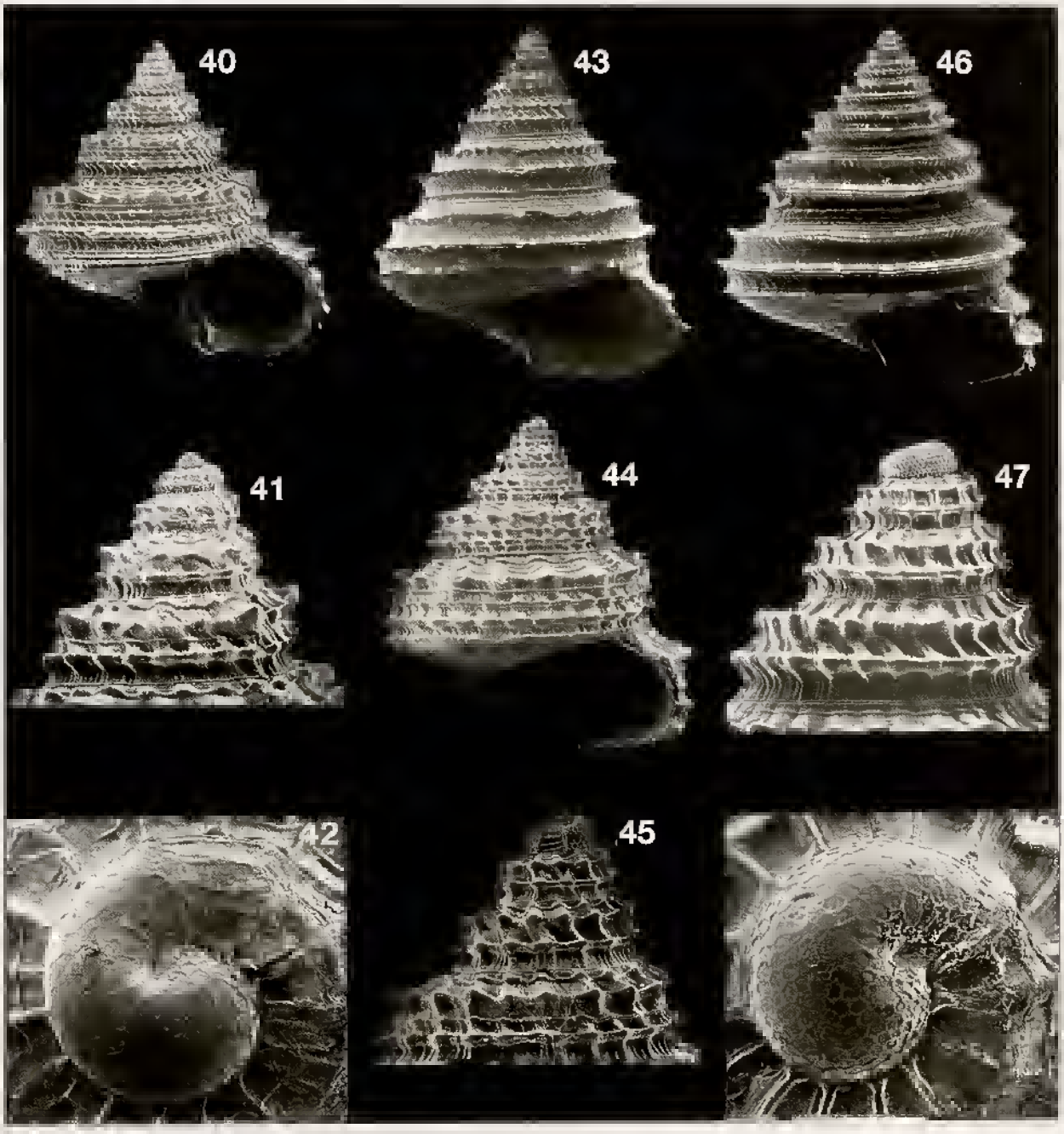
Teleoconch of up to 7.70 whorl; 1st eighth whorl with crisp spiral threads, delineated by strong, rounded varix and growth scar. First 2 whorls convex, subsequent whorls strongly angulated at P2, P3 peripheral, periphery evenly rounded at maturity, base convex, umbilical rim angulate. Spire and base with prominent spiral cords that multiply by intercalation; axial costae strong on 1st 4 or 5 whorls, considerably weaker or almost obsolete thereafter. P2-P4 commencing immediately after post larval scar, strong throughout; P1 a fine thread on 1st 2 whorls then gradually enlarging though remaining weaker than P2-P4; P4 partly covered by succeeding whorls. Secondary spirals remaining weaker than primaries, S1 commencing mid 4th - mid 5th whorl, S2 commencing mid 3rd - mid 5th whorl; S3 absent, positionally represented by fine tertiary spiral on last adult whorl. Tertiary spirals commencing after 5th whorl at varying stages and positions, enlarging to resemble secondaries, 1 per interspace. Nodules on spire roundly conical, axially compressed; strong and uneven-sized on P2 and P3 after 2nd whorl, those on P2 upturned and approximately each 3rd - 4th nodule extremely large; P1 more weakly nodular, secondary and tertiary yet more weakly nodular. Base with 10 or 11 similar rounded spiral cords with low, rounded nodules. Fine collabral growth lines throughout. Umbilicus deep, wall almost vertical, smooth apart from obscure spiral lines, diameter 14.0-25.2 % of shell diameter. Aperture subcircular. Outer lip thin at rim, thickened within. Inner lip thick. Parietal inductura extremely thin.

Animal (MUSORSTOM 5: stn 298) creamy white. Snout dorsoventrally flattened, slender, about twice as long as broad, tip laterally expanded and set with large slender papillae. Cephalic tentacles similar, slender, narrowly tapered, large eyes in prominent outer basal eyestalks. No right neck lobe. Left neck lobe large, about as long as cephalic tentacle, folded, thin in section. Epipodial tentacles slender, enlarging anteriorly, 4 on each side. Foot large, long and narrow, tip blunt, prominently anterolaterally cared, sides irregularly pustulate. Operculum typical, reddish brown.

Radula (Fig. 126) with the formula ∞ + 5 + 1 + 5 + ∞. Central and lateral teeth thin in section, flexible, tips finely serrate. Tip of central tooth narrowly angulate, tips of lateral teeth extremely slender. Innermost pair of marginal teeth stout, with 5 or 6 stout cusps. Next marginal narrower and longer, tip smaller and with 5 or 6 stout cusps. Outer marginals slender, tips with small slender cusps.

Jaw plates with elongate elements at leading edges.

Source : MNHN, Paris



FIGS 40-48. — Genus *Calliostoma*, subgenus *Benthastelena*. — **40-42**, *Calliostoma (Benthastelena) diadematum*, holotype, 11.0 × 10.5 mm, 41 × 18, 42 × 128. — **43**, *C. (B.) cristatum*, MUSORSTOM 4: stn DW 164, 9.70 × 8.40 mm. — **44-45**, *C. (B.)* sp. cf. *diadematum*, MUSORSTOM 4: stn DW 204, 6.60 × 5.80 mm, 45 × 24. — **46-48**, *C. (B.) cristatum*, holotype, 10.2 × 8.80 mm, 47 × 32, 48 × 112.

Source : MNHN, Paris

TABLE 10. — *Calliostoma (Benthastelena) diadematum*. Shell measurements (mm) and countings (MUSORSTOM 5: stns 255, 258, 270, 276, 295, 298).

Character	*n*	Range	Mean	SD
H	9	8.40-12.70	10.47	1.37
D	9	7.15-11.90	09.6	1.40
H/D	9	1.04-01.17	01.09	0.04
TW	9	6.50-07.70	07.08	0.35

REMARKS. — This species is similar to *C. (B.) katherina* from off New South Wales and Queensland (Figs 37-38), and is obviously closely related. *C. (B.) diadematum* differs from the Australian species, however, in numerous points of detail, including more exsert protoconch, coarser sculpture, considerably wider umbilicus, with the shoulder (P2) at adapical 3rd instead of submedian on later whorls. The two subadult specimens from off Chesterfield Islands and southern New Caledonia (Figs 44-45) differ from the Argo and Capel Banks type material (Figs 40-42) in having less prominent nodules on P2, and in having S2 stronger at the same stage of growth. These specimens could equally well represent divergent isolated populations of *C. (B.) diadematum* or distinct species.

ETYMOLOGY. — Crowned (Latin).

Calliostoma (Benthastelena) cristatum sp. nov.

Figs 43, 46-48, 127, 156; Table 11

TYPE MATERIAL. — Holotype (10.2 × 8.80 mm, 7.75 TW) MNHN. Paratypes: 9 MNHN, 1 AMS C201708, 2 NMNZ M262473, M262475.

TYPE LOCALITY. — S. New Caledonia, CHALCAL 2, stn DW 83, 23°20′ S, 168°06′ E, 200 m.

MATERIAL EXAMINED. — All type material. **New Caledonia**. LAGON: stn 444, 18°15′ S, 162°59′ E, 300-350 m, 2 lv (paratypes).
CHALCAL 2: stn DW 83, 23°20′ S, 168°06′ E, 200 m, 3 lv (holotype and 1 paratype MNHN, 1 AMS).
MUSORSTOM 4: stn DW 164, 18°33′ S, 163°13′ E, 255 m, 5 lv (paratypes: 4 MNHN, 1 NMNZ). — Stn DW 234, 22°15′ S, 167°08′ E, 350-365 m, 2 lv (paratypes: 1 MNHN, 1 NMNZ).
SMIB 5: stn DW 72, 23°42′ S, 168°01′ E, 400 m, 1 dd (paratype).

DISTRIBUTION (Fig. 156). — Off Récifs d'Entrecasteaux, northern New Caledonia, and off southern New Caledonia (type loc.), 200-400 m, living at 200-365 m.

DESCRIPTION. — *Shell* up to 10.2 mm high, glossy, stout. Spire narrowly and rather evenly conical, 1.90-2.28 × as high as aperture, mean spire angle 57-63°, anomphalous.

Colour of tip of apical fold yellowish brown, rest of protoconch colourless, translucent. First 2 teleoconch whorls, translucent white, subsequent whorls white with broad, irregular, pale yellowish brown maculations, summits of P2-P4 alternately streaked white and yellowish brown. Base white or buff white, 1 or 2 outer and/or inner basal spirals often spotted yellowish brown.

Protoconch 380-400 µm wide, sculptured with network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip rounded, terminal varix strong.

Teleoconch of up to 7.75 whorls; 1st eighth whorl with fine crisp spiral threads, delineated by strong, rounded varix and growth scar. Whorls convex, P3 peripheral, base weakly convex, sharply contracted below P4, last adult whorl becoming evenly convex. Spiral cords on spire and base prominent; axial costae strong on 1st 4 or 5 whorls, obsolete or persisting weakly thereafter. P2-P4 commencing immediately after post larval scar, strong, after 3rd whorl becoming narrowly and sharply angulate in section and flange-like, P2 adapically upturned, P4 partly covered by succeeding whorls. P1 absent or commencing on mid 3rd - early 4th whorl, remaining weak. S2 absent or commencing late 5th - late 6th whorl, remaining weak. Fine tertiary spirals frequently

Source : MNHN, Paris

present on last adult whorl, several in each interspace. Nodules (P2, P3) roundly conical, rather sharp, becoming more or less irregular in size, either persisting throughout or almost obsolete after 4th or 5th whorl. Base with 11-19 weak, inner 2 or 3 weakly nodular, others more or less smooth. Raised collabral growth lines throughout, stronger on base. Aperture subquadrate. Outer lip thin at rim, strongly thickened within, especially on abapical side. Inner lip thick. Parietal inductura extremely thin.

Animal. External anatomy, radula (Fig. 127) and jaws similar to those of *C. (B.) diadematum* sp. nov.

TABLE 11. — *Calliostoma (Benthastelena) cristatum.* Shell measurements (mm) and countings (LAGON: stn 444, MUSORSTOM 4: stns DW 164, DW 234, CHALCAL 2: stn DW 83).

Character	*n*	Range	Mean	SD
H	12	7.65-10.2	8.99	0.76
D	12	6.75-8.80	8.02	0.64
H/D	12	1.05-1.18	1.12	0.49
TW	12	6.80-7.75	7.09	0.27

REMARKS. — *Calliostoma (Benthastelena) cristatum* is similar to *C. (B.) katherina* and *C. (B.) diadematum* sp. nov. in radular and jaw morphology and in gross shell facies, so the three species are evidently related. *C. (B.) cristatum* differs from *C. (B.) diadematum* in lacking an umbilicus, from *C. (B.) katherina* in that P2 is set higher on late teleoconch whorls, and from both species in having weaker secondary sculpture and much finer nodules on late teleoconch whorls. The nodules on the spire whorls tend to weaken from the fourth or fifth whorl in southern specimens but remain relatively stronger in northern specimens, especially on P2 (Figs 43, 46). I am unable to detect any other significant differences between northern and southern specimens, which seem to be regional variants of a single species.

ETYMOLOGY. — Crested (Latin).

Calliostoma (Benthastelena) coronatum sp. nov.

Figs 49-51, 128, 156; Table 12

TYPE MATERIAL. — Holotype (10.5 × 8.50 mm, 7.25 TW) MNHN. Paratypes: 8 MNHN, 1 NMNZ M262474.

TYPE LOCALITY. — S. New Caledonia, CHALCAL 2, stn DW 83, 23°20′ S, 168°06′ E, 200 m.

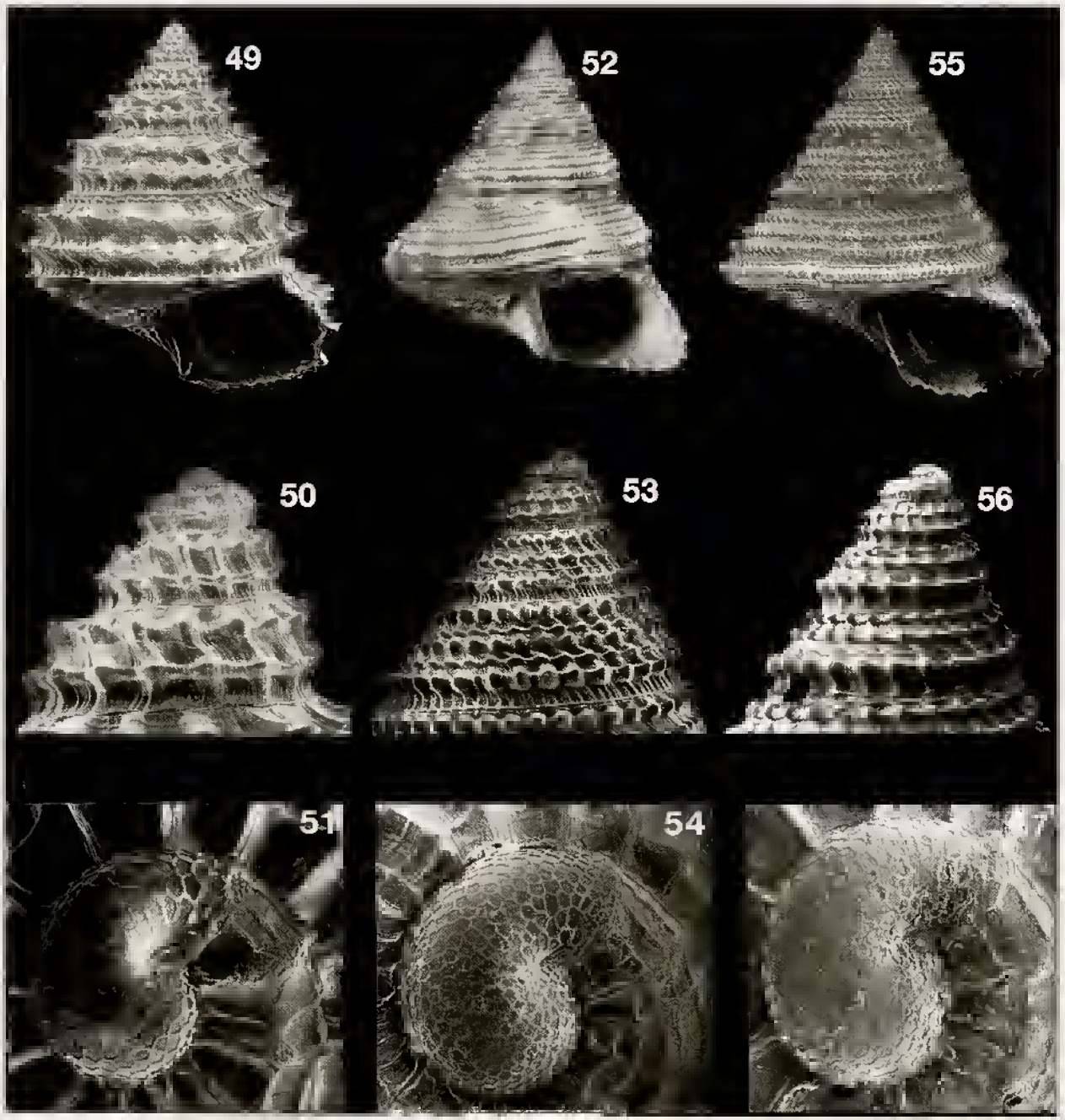
MATERIAL EXAMINED. — All type material. **New Caledonia.** LAGON: stn 394, 22°44′ S, 167°06′ E, 309 m, 1 lv (paratype). — Stn 395, 22°48′ S, 167°08′ E, 313 m, 1 lv (paratype). — Stn 396, 22°40′ S, 167°09′ E, 284 m, 1 dd (paratype). — Stn 497, 18°57′ S, 163°28′ E, 255 m, 1 lv (paratype). CHALCAL 2: stn DW 83, 23°20′ S, 168°06′ E, 200 m, 2 lv (holotype, paratype NMNZ). MUSORSTOM 4: stn CP 172, 19°01′ S, 163°16′ E, 275-330 m, 1 dd (paratype). — Stn CC 173, 19°02′ S, 163°19′ E, 250-290 m, 1 dd (paratype). — Stn CC 175, 18°59′ S, 163°17′ E, 355 m, 1 lv (paratype). — Stn DW 227, 22°46′ S, 167°20′ E, 300 m, 1 dd (paratype).

DISTRIBUTION (Fig. 156). — Off Grand Récif de Cook, northern New Caledonia, and off southern New Caledonia, 200-355 m, living at 200-355 m.

DESCRIPTION. — *Shell* up to 10.9 mm high, glossy, stout, spire rather narrowly conical, 1.73-1.77x as high as aperture, mean spire angle 55-62°, anomphalous.

Protoconch white; teleoconch whorls pale buff, 1st 2 whorls with yellowish brown spots on spirals, following whorls with narrow, irregular, white axial bands, small irregular yellowish brown patches, and irregular yellowish brown streaks at summits of spiral cords. P4 alternately maculated with yellowish brown and white. Base pale buff, occasionally uniformly pigmented though usually outer and inner or all

Source : MNHN, Paris



FIGS 49-57. — Genus *Calliostoma*, subgenus *Benthastelena*. — **49-51**, *Calliostoma (Benthastelena) coronatum*, holotype, 10.5 × 8.50 mm, 50 × 37, 51 × 116. — **52**, *C. (B.) tosaense*, MUSORSTOM 6: stn CP 465, 22.4 × 20.4 mm. — **53-54**, *C. (B.) tosaense*, MUSORSTOM 5: stn 379, 53 × 18, 54 × 100. — **55-57**, *C. (B.) pertinax*, holotype, 11.5 × 9.60 mm, 56 × 19, 57 × 128.

spirals alternately spotted yellowish brown and white. Pale green nacreous layer showing through translucent outer shell layer on spire.

Protoconch 333-370 µm wide, sculptured with network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip, rounded, terminal varix strong.

Teleoconch of up to 7.40 whorls; 1st eighth whorl with crisp spiral threads, delineated by strong, rounded varix. Whorls convex, angulated at P4, periphery becoming rounded on last adult whorl, base weakly convex. Prominent spiral cords on spire and base; axial costae strong on 1st 4 whorls, almost obsolete on subsequent whorls. P2-P4 commencing immediately after post larval scar, higher than broad after 3rd whorl, P2 and P3 very strong and similar throughout; P4 weaker, partly covered by succeeding whorls; P1 commencing mid 3rd - mid 5th whorl, weak throughout; few fine tertiary spirals appearing in primary interspaces on last adult whorl. Nodules small and rounded on P1; very strongly axially compres-

Source : MNHN, Paris

sed, gently adapically upturned, and sharply and narrowly angulate in lateral section on P2 and P3. Base with 7-14 more or less similar spiral cords, nodules small, low, rounded; radially pleated, more strongly in southern than in northern specimens. Fine collabral growth lines throughout, stronger on base. Aperture subcircular. Outer lip thin at rim, thickened within, strongly so abapically. Inner lip thick. No parietal inductura.

Animal. External anatomy, radula (Fig. 128) and jaws similar to those in *C. (B.) katherina*.

TABLE 12. — *Calliostoma (Benthastelena) coronatum*. Shell measurements (mm) and countings (LAGON: stns 394, 395, 396, 497, CHALCAL 2: stn DW 83, MUSORSTOM 4: stns CP 172, CC 173, CC 175, DW 227).

Character	*n*	Range	Mean	SD
H	10	7.20-10.90	9.60	1.17
D	10	6.60-09.00	8.18	0.69
H/D	10	1.08-01.33	1.17	0.08
TW	10	6.30-07.40	7.04	0.39

REMARKS. — *Calliostoma (Benthastelena) coronatum* bears a superficial resemblance to *C. (B.) diadematum*, from which it differs, however, in numerous sculptural details. More obvious differences include a lack of an umbilicus, lack of secondary spiral cords on all but the last adult whorl, and in that P2 and P3 are more similar to each other. Northern specimens differ from southern specimens in having weaker axial sculpture on the base, but otherwise appear to be indistinguishable.

ETYMOLOGY. — Crowned (Latin).

Calliostoma (Benthastelena) tosaense (Kuroda & Habe, 1961)

Figs 52-54, 154, 156; Table 13

Tristichotrochus tosaensis Kuroda & Habe *in* Habe, 1961: 10, app. 3, pl. 5, fig. 14.

Other references:

Tristichotrochus tosaensis - HABE, 1964: 14, pl. 5, fig. 14. — AZUMA, 1961: text fig. 1.
Calliostoma (Tristichotrochus) sp. cf. *tosaensis* — MARSHALL, 1979: 538, fig. 7GH.
Calliostoma (Tristichotrochus) tosaensis — KOSUGE, 1984: 6, pl. 2, figs 11-12.

TYPE MATERIAL. — Holotype NSMT.

TYPE LOCALITY. — Tosa Bay, Japan.

MATERIAL EXAMINED. — **New Zealand**. NZOI, stn K858, 30°34.2′ S, 178°29.8′ W, off Curtis I., Kermadec Is. 465-501 m, 1 dd (NZOI).
Chesterfield Islands. MUSORSTOM 5: stn 379, 19°53′ S, 158°40′ E, Chesterfield Reefs, 370-400 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 459, 21°01′ S, 167°31′ E, off Lifou, 425 m, 1 dd. — Stn CP 465, 21°04′ S, 167°32′ E, off Lifou, 480 m, 1 dd.
Japan. Tosa Bay, ca. 100-200 m, 2 spms (NMNZ).
Philippine Islands. Bohol Straits, ca.150-200 m, 3 spms (NMNZ).

DISTRIBUTION (Figs 153, 156). — Southern Japan, Philippine Islands, Chesterfield Islands, Loyalty Ridge, Kermadec Islands, ca. 100-501 m. Depth range of living animals unknown.

Source : MNHN, Paris

TABLE 13. — *Calliostoma (Benthastelena) tosaense*. Shell measurements (mm) and countings.

H	D	H/D	TW	
09.6	09.0	1.07	6.20	MUSORSTOM 5: stn 379
16.8	16.0	1.05	7.30	Bohol Straits (NMNZ)
19.3	18.7	1.03	7.80	Tosa, Japan (NMNZ)
20.8	19.8	1.05	8.00	Tosa, Japan (NMNZ)
22.0	20.8	1.06	8.00	Bohol Straits (NMNZ)
22.4	20.4	1.10	8.40	MUSORSTOM 6: stn CP465
23.0	21.6	1.06	8.30	Bohol Straits (NMNZ)

REMARKS. — I am unable to detect any taxonomically significant differences between the specimens examined (Table 13), suggesting that a single exceptionally widely distributed species is represented. This species is distinctive among *Benthastelena* species in the combination of large size (height up to 22.8 mm), weakly convex teleoconch whorls, lack of shoulder angulation, sharply pointed nodules on spire, and peripheral P3 and S3.

Calliostoma (Benthastelena) pertinax sp. nov.

Figs 55-57, 155

TYPE MATERIAL. — Holotype (11.5 × 9.60 mm, 7.50 TW) and 2 paratypes MNHN.

TYPE LOCALITY. — S. New Caledonia. BIOCAL, stn CP 108, 22°03′ S, 167°06′ E, 335 m.

MATERIAL EXAMINED. — All type material. **New Caledonia**. LAGON: stn 993, 20°15′ S, 163° 53′ E, 375-400 m, 1 dd (paratype).
BIOCAL: stn CP 108, 22°03′ S, 167°06′ E, 335 m, 1 dd (holotype).
MUSORSTOM 4: stn CC 247, 22°09′ S, 167°13′ E, 435-460 m, 1 dd (paratype: 10.7 × 9.40 mm, 7.40 TW).

DISTRIBUTION (Fig. 155). — Off northern and southern New Caledonia, 335-460 m (dead).

DESCRIPTION. — *Shell* up to 11.5 mm high, glossy, of moderate thickness, spire evenly conical, 2.00-2.31x as high as aperture, mean spire angle 57°, anomphalous.

Colour of tip of protoconch apical fold yellowish brown, rest of protoconch and most of 1st teleoconch whorl pale buff, 2nd whorl yellowish brown, subsequent whorls white. P3, S3, P4 and basal spirals spotted yellowish brown.

Protoconch 400 µm wide, sculptured with network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold lip rounded, terminal varix strong.

Teleoconch of up to 7.50 whorls; 1st eighth whorl with crisp spiral threads, delineated by strong rounded varix and growth scar. First 2 whorls convex, 3rd whorl becoming almost flat, subsequent whorls almost flat, suture weakly impressed, periphery angulate, S3 peripheral, base weakly convex. Spire and base with prominent, rounded spiral cords that multiply by intercalation; axial costae strong on 1st 4 whorls, almost obsolete on subsequent whorls. Nodules on spire roundly conical in axial section, laterally compressed, adapical extremities overhanging bases of spirals; basal nodules lower, rounded. P2-P4 commencing immediately after post larval scar; P2 and P3 strong and similar on 1st 2 whorls, P3 larger on subsequent whorls; P1 commencing on mid 2nd whorl, enlarging to resemble P2; P4 weakest, partly covered by succeeding whorls. S1 commencing late 7th - early 8th whorl, weak; S2 commencing mid - late 3rd whorl, enlarging to resemble P1 and P2; S3 commencing mid 3rd - start 4th whorl, becoming as large as P3 and peripheral. Tertiary spirals weak, 2 or 3 at end of last adult whorl, 1 per interspace. Base with 10-12 similar primary spiral cords, a secondary in most interspaces on last half whorl. Fine collabral growth lines throughout. Aperture subquadrate. Outer lip thin at rim, thickened within, strongly so on abapical side. Inner lip thick. Parietal inductura thin.

Animal unknown.

REMARKS. — *Calliostoma (Benthastelena) pertinax* bears a general resemblance to *C. (B.) tosaense* (Fig. 53) in early teleoconch morphology but differs in numerous details of teleoconch sculpture. These differences include much later appearance of S1, more rapid enlargement of S3, and

Source : MNHN, Paris

lack of radial pleats between P3 and P4 on the early teleoconch whorls. Judging from the slight constriction and descent of the end of the last whorl, the holotype of *C. (B.) pertinax* is evidently an adult, so the species attains about half the size of *C. (B.) tosaense*. Although it differs in sculptural details, *C. (B.) pertinax* is strikingly similar to *C. sueri* Finlay, 1923 (Beu & Maxwell, 1990: pl. 19j) and *C. fragile* Finlay, 1923 from the Lower Miocene of New Zealand. The latter species, incidentally, is the type species of *Venustas* Allan, 1926.

Etymology. — Firm (Latin).

Subgenus *Ampullotrochus* Monterosato, 1890

Ampullotrochus Monterosato, 1890: 145. Type species (by monotypy): *Trochus granulatus* Born, 1778; Recent, Europe.

Diagnosis. — *Shell* up to about 30 mm high, spire narrowly conical, periphery angulate, anomphalous, all teleoconch whorls but 1st more or less flat-sided. P1-P3 commencing immediately or P1 commencing later than P2 and P3, axial sculpture strong on early teleoconch whorls, persistent in some species, producing fine, crisp reticulation; nodules rounded or roundly conical, enlarged at periphery in some species, elsewhere small. External anatomy, radula and jaws similar to those in *Calliostoma* (*s. str.*).

Remarks. — *Ampullotrochus* is allowed subgeneric status for a group of species that differ from *Calliostoma* (*s. str.*) primarily in having strongly flattened, finely nodular early teleoconch whorls, and axial costae that are stronger, more sharply defined and persistent. The combination of sculptural character states, particularly on the early teleoconch whorls, produces a distinctive facies, which, however, is difficult to quantify or more objectively describe. The two groups are sharply delineated, although both exhibit considerable degrees of interspecific variation. Apart from the type species (Fig. 21) and the taxa described below, the subgenus includes *C. (A.) gubbiolii* Nofroni, 1984 (western Mediterranean and north western Africa) and *Tristichotrochus iris* Kuroda & Habe, 1961 (southern Japan), while several undescribed species occur off the Philippines Island (NMNZ).

Shells of *Ampullotrochus* species are superficially similar to those of some species of *Astele*, all of which differ, however, in having stronger spiral lirae on the first teleoconch whorl, while the nodules on P3 are typically alternately enlarged on the early teleoconch whorls. Moreover, *Astele* species are extremely distinctive in that the innermost marginal teeth are relatively huge and extremely stout, each with a large secondary cusp on the inner side. *Astele*, as here interpreted, includes (as a synonym) *Salsipotens*, the type species of which (*Trochus armillatus* Wood, 1828) has similar radular and early teleoconch morphology. Although *A. armillatum* is more narrowly conical than *A. subcarinatum* and lacks an umbilicus, narrowly conical species *with* umbilicuses occur in the Australian Tertiary (e.g. *Calliostoma semioruata* Chapman, 1926). Moreover, the southern Australian Recent species *Astele ciliare* (Menke, 1843) is both anomphalous and as broadly conical as *A. subcarinatum*.

Calliostoma (Ampullotrochus) xanthos sp. nov.

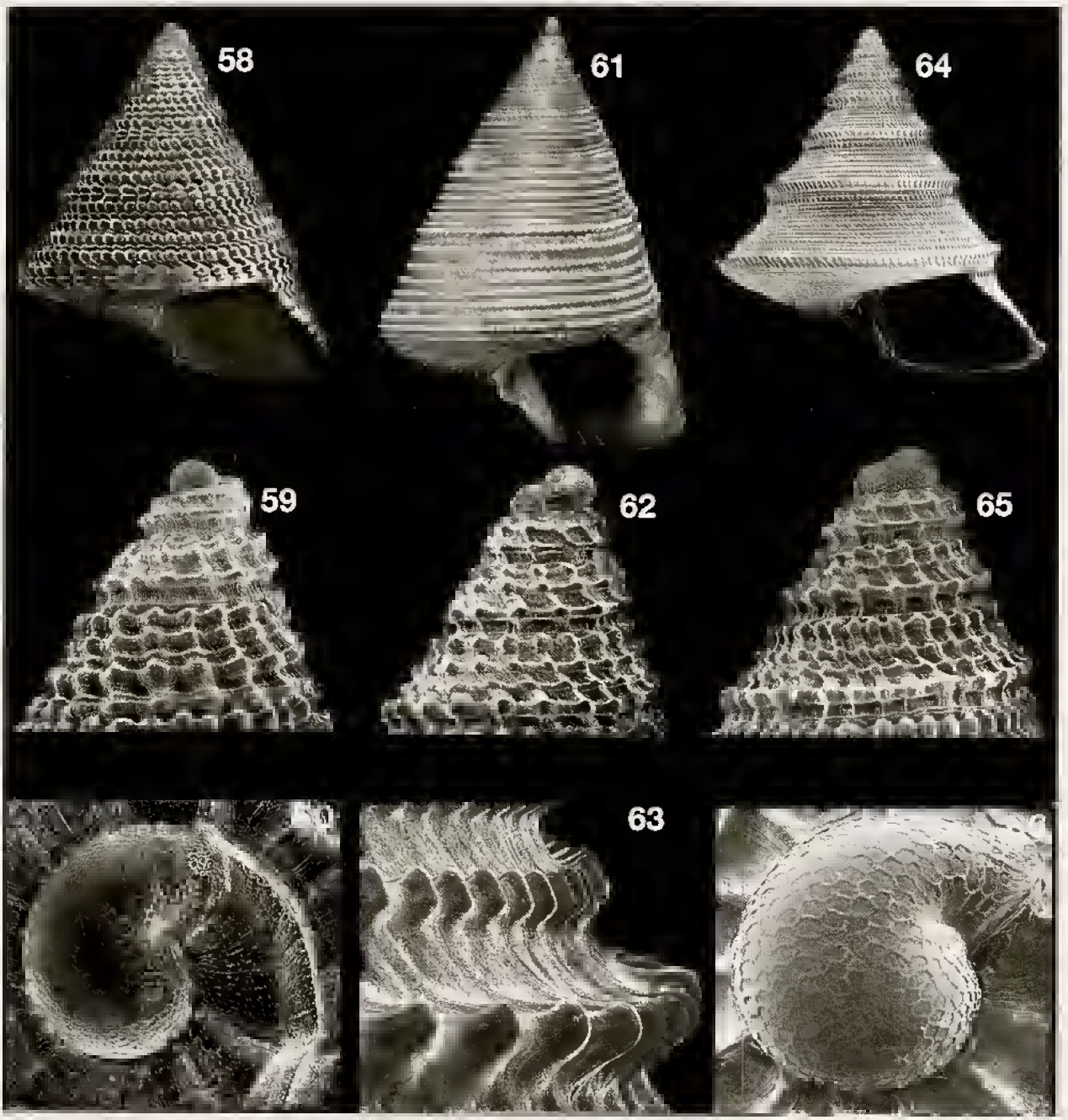
Colour Plate; Figs 58-60, 129, 155; Table 14

Calliostoma (Tristichotrochus) sp. cf. *simplex* - Marshall, 1979: 537, figs 7C-D only (not *C. simplex* Schepman, 1908).

Type material. — Holotype MNHN.

Type locality. — S. New Caledonia, CHALCAL 2, stn DW 76, 23°41′ S, 167°45′ E, 470 m.

Source : MNHN, Paris



FIGS 58-66. — Genus *Calliostoma*, subgenus *Ampullotrochus*. — **58-60**, *Calliostoma (Ampullotrochus) xanthos*, holotype, 8.00 × 6.90 mm, 59 × 29, 60 × 104. — **61**, *C. (A.) peregrinum*, holotype, 27.4 × 19.5 mm. **62-63**, *C. (A.) peregrinum*, paratype, SMIB 4: stn DW 53, 62 × 25, 63 × 36 (detail of adult spire sculpture). — **64-66**, *Calliostoma (A.) heros*, holotype, 11.6 × 10.2 mm, 65 × 26, 66 × 128.

MATERIAL EXAMINED. — **New Caledonia**. CHALCAL 2: stn DW 76, 23°41′ S, 167°45′ E, 470 m, 1 dd (holotype).
Loyalty Islands. MUSORSTOM 6: stn DW 459, 21°01′ S, 167°31′ E, 425 m, off Lifou, 1 lv.
New Zealand. NZOI stn K826(3), 28°48′ S, 177°48′ E, 390-490 m, off Raoul I., Kermadec Is, 25.7.1974, 1 dd (NZOI).

DISTRIBUTION (Fig. 155). — Off Lifou, Loyalty Islands (425 m), south of Ile des Pins, southern New Caledonia (470 m, alive), off Raoul Island, Kermadec Islands (390-490 m).

Source : MNHN, Paris

DESCRIPTION. — *Shell* (immature holotype) 8.00 mm high, glossy, stout; spire narrowly and evenly conical, 2.48x higher than aperture, mean spire angle 54°, anomphalous.

Colour of protoconch and 1st teleoconch whorl pale buff, 2nd and most of 3rd whorl white, subsequent whorls pale buff; S3 and P4 yellowish brown between nodules, base white.

Protoconch 420 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces, apical fold tip tightly rounded, terminal varix strong.

Teleoconch of 6.50 whorls; 1st quarter whorl with crisp spiral threads and strong varix, delineated by growth scar and low varix. First whorl strongly convex, 2nd whorl becoming weakly convex, subsequent whorls flat with flush suture; periphery angulate, S3 and P4 peripheral, base weakly convex. Spire and base with prominent, rounded, nodular spiral cords that multiply by intercalation; axial costae strong on 1st 3.5 whorls, weakening and becoming obsolete over next whorl. Nodules on spire rounded on 1st 3 whorls; thereafter in lateral profile sharply shelved adapically, rounded abapically, on S3 and P4 elliptical and axially compressed in plan view and semicontiguous, elsewhere rounded. Basal nodules considerably smaller, rounded. P2-P4 commencing immediately after post larval growth scar; P2 and P3 strong and similar throughout; P4 narrower, almost entirely exposed on spire; P1 commencing at start of 2nd whorl, as large as P2 and P3 by 3rd whorl. Secondary spirals enlarging to resemble primaries, S1 commencing early 6th whorl, S2 and S3 commencing mid 3rd whorl. Fine collabral growth lines throughout. Base with 16 spiral cords in front of parietal area, outer 3 weaker, closest. Aperture subquadrate. Outer lip thin at rim, thickened within. Inner lip thick. Parietal glaze very thin.

Animal (holotype). Snout dorsoventrally flattened, nearly twice as long as broad, tip laterally expanded and edged with crowded, slender papillae. Cephalic tentacles narrowly tapered, rather short, little longer than snout; eyestalks at outer bases continuous with prominent cephalic lappets. Left and right neck lobes very large, thin in section. Epipodial tentacles small, 3 right and 4 left. Foot large, long and narrow, sides with rounded pustules. Operculum typical, reddish brown.

Radula (Fig. 129) similar to that of *C. (A.) granulatum* but with 6 instead of 5 pairs of lateral teeth, each with more narrowly tapered cutting area.

TABLE 14. — *Calliostoma (Ampullotrochus) xanthos*. Shell measurements (mm) and countings.

H	D	H/D	TW	
08.0	06.90	1.16	6.50	Holotype
14.6	12.80	1.14	8.50	MUSORSTOM 6: stn DW 459
19.6	15.20	1.29	9.40	NZOI stn K826(3)

REMARKS. — Although similar to the holotype in gross facies and apparently conspecific, the specimens from Lifou and Raoul Island exhibit some sculptural differences. In the Lifou specimen, P1 enlarges more rapidly on the 1st whorl, and S2 and S3 commence earlier (early 3rd and mid 2nd whorls respectively), but the first four whorls are otherwise similar. Following the 4th whorl, P1, P2, S2 and P3 become much wider, gradually dividing medially, while they are sharply shelved both adapically and abapically (shelved adapically, rounded abapically in holotype). Since multiplication of spire spirals by fission is extremely rare in normal calliostomatids, it seems probable that the Lifou specimen has grown abnormally, perhaps due to injury associated with a repaired fracture early on the 3rd whorl. The Raoul Island specimen (MARSHALL, 1979: figs 7C-D), similar to the holotype in early teleoconch facies, differs from it in the later appearance of S2 (early 8th whorl) and tertiary spirals (late 7th whorl), and differs from both the holotype and the Lifou specimen in having considerably stronger, more widely spaced nodules on S3 and P4. The Raoul Island specimen is interpreted as either an inter or intrapopulational variant.

C. xanthos corresponds in a general way with the original description and illustration of *C. quadricolor* Schepman, 1908. Unfortunately the only known syntype (ZMA, *"Siboga"*, stn 49A, Sape Strait, Flores, Indonesia, 69 m) is clearly neither the originally described nor the illustrated specimen, which was thus presumably the one recorded from *"Siboga"*, stn 257 (off Kai Is, Indonesia, 52 m) and evidently lost (MOOLENBEEK pers. comm.). The extant syntype (height 6.60 mm, diameter 6.10 mm), now bleached and etched due to prolonged storage in acidic alcohol, differs from *C. (A.) xanthos* in the earlier appearance of P1, and in that S3 becomes peripheral and larger than P4.

The Raoul Island specimen was originally thought to be related to *C. simplex* Schepman, 1908 (MARSHALL, 1979), but the holotype of that species differs in colour and sculptural details. *C. simplex* is much closer to *C. (F.) compsum* and thus probably belongs in subgenus *Fautor*.

Source : MNHN, Paris

Calliostoma (Ampullotrochus) peregrinum sp. nov.

Figs 61-63, 130, 153; Table 15

Calliostoma (Tristichotrochus) sp. cf. *simplex* - MARSHALL, 1979: 537, figs 7E-F only (not *C. simplex* Schepman, 1908).

TYPE MATERIAL. — Holotype and 4 paratypes MNHN.

TYPE LOCALITY. — S. New Caledonia, SMIB 4, stn DW 52, 23°41′ S, 168°1′ E, 235-250 m.

MATERIAL EXAMINED. — **New Caledonia**. SMIB 3: stn DW 8, S. New Caledonia, 24°45′ S, 168°08′ E, 233 m, 1 dd.
SMIB 4: stn DW 45, 24°46′ S, 168°09′ E, 245-260 m,1 lv (paratype). — Stn DW 52, 23°41′ S, 168°1′ E, 235-250 m, 1 lv (holotype). — Stn DW 53, 23°40′ S, 168°00′ E, 250-270 m, 1 dd (paratype).
SMIB 5: stn DW 75, 23°41′ S, 168°01′ E, 270 m, 1 dd.
Loyalty Islands. SMIB 5: stn DW 90, 22°19′ S, 168°42′ E, 340 m, 1 dd (paratype). — Stn DW 93, 22°20′ S, 168°42′ E, 255 m, 1 lv (paratype).
New Zealand. NZOI stn Z2098, 28°39.5′ S, 173°01′ E, Betty Guyot, N. Three Kings Rise, New Zealand, 841 m, 4.9.1967 1 dd (NZOI).

DISTRIBUTION (Fig. 154). — South of Loyalty Islands and south of Ile des Pins, southern New Caledonia, 233-340 m (living at 235-260 m) and northern Three Kings Rise, northern New Zealand, 841 m (dead).

DESCRIPTION. — *Shell* up to 27.4 mm high, glossy, stout; spire narrowly conical, weakly cyrtoconoid, 2.11-2.31x higher than aperture, mean spire angle 51-55° anomphalous.

Colour of tip of apical fold pale buff, rest of protoconch and most of 1st teleoconch whorl white; next 2 or 3 whorls buff white with irregular yellowish brown maculations. Subsequent whorls pale yellowish brown, P3 irregularly alternately spotted white and yellowish brown until last adult whorl, other spirals translucent white.

Protoconch 420-470 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces. Apical fold tip rounded, terminal varix rounded.

Teleoconch of up to 9.80 whorls, 1st eighth whorl with crisp spiral threads, delineated by growth scar and strong, rounded varix. First and most of 2nd whorl convex, subsequent whorls flat with flush suture; periphery angulate, tightly rounded at maturity, P3 peripheral; base weakly convex. Spire and base with prominent spiral cords, spire spirals multiplying by intercalation; axial costae strong on 1st 3 whorls, weakening on 4th whorl, becoming obsolete on 5th whorl. Nodules on 1st 3 whorls rounded, on subsequent spire whorls somewhat prism-shaped (*i.e.* rather sharply angulate though with flattened summits), most prominent on P3; nodules on basal spirals weaker, rounded. P2-P4 commencing immediately after post larval growth scar, P2 and P3 strong and similar on 1st 2 whorls, P3 thereafter stronger, peripheral. P1 a fine thread on 1st whorl, becoming as large as P2 on 2nd whorl; P4 partly covered by succeeding whorls. Secondary spirals enlarging to resemble P1 and P2, S1 commencing mid 4th whorl, S2 commencing early to mid 3rd whorl. Tertiary spirals 2, enlarging to resemble P1, P2 and secondaries, commencing on 4th or 5th whorl in P2-S2 and S2-P3 interspaces. Spire spiral interspaces about as wide as each spiral on early whorls, becoming considerably wider than each spiral. Base with 14 or 15 similar rounded spiral cords. Fine collabral growth lines throughout. Aperture subquadrate. Outer lip thin at rim, thickened within. Inner lip thick. Parietal inductura thin, translucent.

Animal. External anatomy unknown (dried).

Radula (Fig. 130) with 6 pairs of lateral teeth, outer 2 pairs lacking serrated tips, other teeth and jaws similar to those in *C. (A.) granulatum*.

TABLE 15. — *Calliostoma (Ampullotrochus) peregrinum*. Shell measurements (mm) and countings.

H	D	H/D	TW	
17.0 (est.)	14.7	1.16	8.50 (est.)	SMIB 3: stn DW 8
20.2	16.0	1.26	9.00	SMIB 4: stn DW 53
21.0 (est.)	17.0	1.23	9.30 (est.)	SMIB 4: stn DW 45
27.4	19.5	1.40	9.80	Holotype

REMARKS. — *Calliostoma (Ampullotrochus) peregrinum* differs from *C. (A.) xanthos* in having a mottled colour pattern on the early teleoconch whorls, and in lacking the dark pigmentation on S3 and P4. It differs further in sculptural details, particularly in having substantially finer nodules and

Source : MNHN, Paris

more widely spaced spiral cords. It is apparently most closely related to the southern Japanese species *C. (A.) iris*, from which it differs in having stronger spiral cords, especially on the periphery, with nodules that are more sharply bevelled on their adapical and abapical sides.

ETYMOLOGY. — Travelling about (Latin), alluding both to its distribution and changing taxonomic status.

Calliostoma (Ampullotrochus) heros sp. nov.

Colour Plate; Figs 64-66, 131, 153; Table 16

TYPE MATERIAL. — Holotype and 3 paratypes MNHN.

TYPE LOCALITY. — Loyalty Islands, MUSORSTOM 6, stn DW 482, 21°21′ S, 167°47′ E, off Maré I., 375 m.

MATERIAL EXAMINED. — **Loyalty Islands**. MUSORSTOM 6: stn 459, 21°01′ S, 167°31′ E, 425 m, 2 dd (paratypes). — Stn DW 482, 21°21′ S, 167°47′ E, off Maré I., 375 m, 1 lv (holotype). SMIB 5: stn DW 87, 22°19′ S, 168°41′ E, 370 m, 1 dd . — Stn DW 93, 22°20′ S, 168°42′ E, 255 m, 1 dd (paratype).

DISTRIBUTION (Fig. 154). — Off Loyalty Islands, 255-425 m, living at 375 m.

DESCRIPTION. — *Shell* up to 14.4 mm high, glossy, lightly built; spire narrowly conical, weakly coeloconoid, 1.92-2.0 × as high as aperture, mean spire angle 58-62°, umbilicus narrow.

Colour of protoconch and most of 1st teleoconch whorl translucent white. Subsequent spire whorls yellowish brown with paler patches (about 6 on 7th whorl), P3 closely alternately spotted yellowish brown and white. Base pale yellowish brown, with or without 2 spiral rows of yellowish brown streaks midway between periphery and columella.

Protoconch 470-480 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces. Apical fold tip rounded, terminal varix strong.

Teleoconch of up to 7.80 whorls, growth scar immediately following protoconch. First whorl convex, subsequent whorls sharply angulated at P3, shoulder slope steep and concave, base weakly convex. Spire and base with prominent, rounded spiral cords that multiply by intercalation; axial costae strong on 1st 4 whorls, finer and closer on all subsequent whorls, including base. Nodules on S3 strongest, rounded, conical, forming close saw-tooth serration; nodules on other spire whorls small, rounded, crowded. P2-P4 commencing immediately; P2 and P3 strong throughout, P3 strongest, peripheral; P1 commencing late on 1st whorl, rapidly enlarging to resemble P2; P4 partly covered by succeeding whorls. Secondary spirals enlarging to resemble primaries, S1 commencing mid to late 3rd whorl, S2 commencing late 2nd - early 3rd whorl, S3 absent. Tertiary spirals slowly enlarging to resemble primaries and secondaries, 1 per interspace, earliest commencing between P2 and S2 on early to late 4th whorl, others commencing in varying order and position. Base with 20-24 low, rounded spiral cords, nodules rounded, strongest on inner 2 spirals and very weak elsewhere in subadult holotype, nodules on other spirals enlarging on last adult whorl. Umbilicus narrow, conical, diameter 8.4 - 10.2 % of shell diameter, partly overhung by inner lip rim. Aperture subquadrate. Outer lip thin at rim modestly thickened within. Inner lip thin, rim free. Parietal inductura present only in adults, extremely thin, translucent.

Animal. Snout fringed with prominent papillae. Cephalic tentacles long and slender, flattened, narrowly tapered, prominent eyestalks with well developed eyes at outer bases. Neck lobes prominent, thin, left lobe considerably larger than right. Epipodial tentacles slender, 3 on each side.

Radula (Fig. 131) similar to that of *C. (A.) granulatum* but with 6 instead of 5 pairs of lateral teeth, their tips more narrowly tapered.

TABLE 16. — *Calliostoma (Ampullotrochus) heros*. Shell measurements (mm) and countings.

H	D	H/D	TW	
14.4	11.5	1.25	8.50	SMIB 5: stn DW 93
13.7	12.6	1.09	7.75	MUSORSTOM 6: stn DW 459
11.6	10.2	1.14	7.80	Holotype

Source : MNHN, Paris

REMARKS. — This extremely distinctive species differs from all other known *Ampullotrochus* species in its fine sculpture, pagodiform spire, and concave-sided spire whorls.

ETYMOLOGY. — Named after Virginie Heros (MNHN).

Calliostoma (Ampullotrochus) alisi sp. nov.

Figs 67-69, 132, 157

TYPE MATERIAL. — Holotype (14.7 × 12.7 mm, 7.60 TW) and 1 paratype (13.8 × 11.9 mm, 7.50 TW) MNHN.

TYPE LOCALITY. — Loyalty Islands. MUSORSTOM 6, stn CP 464, 21°02'S, 167°32' E, off Lifou, 430 m.

MATERIAL EXAMINED. — All type material. **Loyalty Islands**. MUSORSTOM 6: stn 459, 21°01' S, 167°31' E, 425 m, 1 lv (paratype). — Stn CP 464, 21°02'5, 167°32' E, off Lifou, 430 m, 1 lv (holotype).

DISTRIBUTION (Fig. 157). — Off Lifou, Loyalty Islands, 425-430 m (living).

DESCRIPTION. — *Shell* up to 14.7 mm high, glossy, stout; spire narrowly and rather evenly conical, 1.77-1.90x as high as aperture; mean spire angle 57°, anomphalous.

Colour of spire pale orange, base and nodules on S3 white.

Protoconch 430 μm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces, apical fold lip broadly rounded, terminal varix strong.

Teleoconch of up to 7.60 whorls; 1st quarter whorl with 5 spiral threads, clearly delineated by strong, rounded varix and growth scar. First whorl convex, subsequent whorls more or less flat; periphery sharply angulated, surmounted by S3, overhanging subsequent whorls; base weakly convex. Spire with prominent, rounded, nodular, spiral cords that multiply by intercalation, interspaces broader than each spiral; nodules prominent, roundly conical, adapical edges sharply shelved, summits slightly but distinctly upturned; axial costae rounded, persistent throughout. P1 weak and P2 and P3 strong and similar on 1st whorl; P4 weak throughout and partly covered by succeeding whorls; P1 rapidly enlarging and resembling P2 on 2nd whorl, broader than P2 on 3rd - 5th whorls, after which as broad as P2; P3 more prominent than P1 and P2 after 1st whorl. S1 commencing on mid 4th - mid 5th whorl, S2 commencing on early - mid 3rd whorl, both enlarging to resemble P2; S3 commencing on mid 3rd whorl, close beside P4, becoming peripheral and slightly larger than P3. Base with 10 or 11 similar, rounded spiral cords with bluntly rounded nodules. Fine collabral growth lines throughout, spiral interspaces finely granulate on earliest whorls. Aperture subquadrate. Outer lip thin at rim, thickened within, especially abapically. Inner lip thick. Parietal inductura very thin.

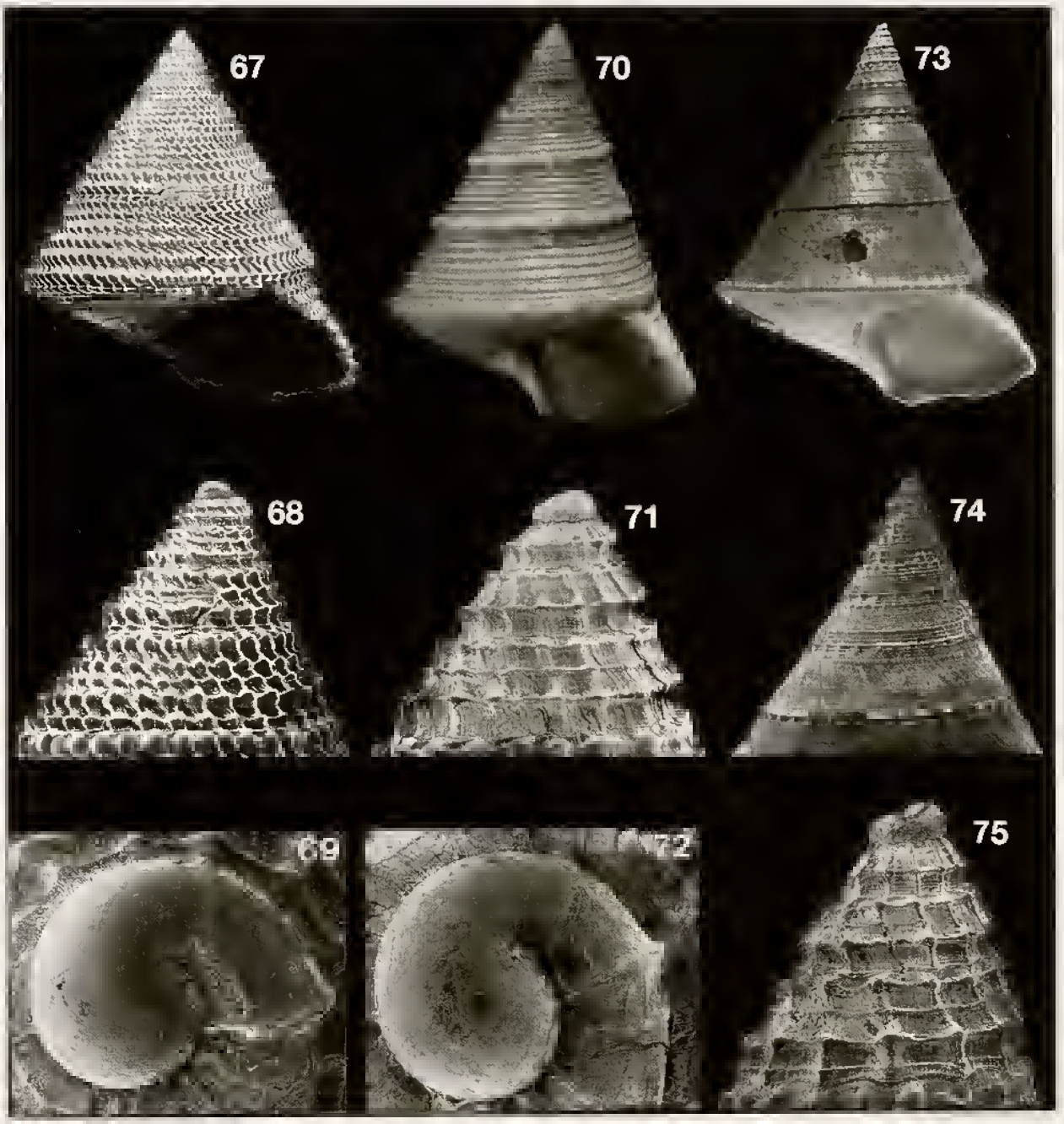
Animal. Snout subrectangular, longer than broad, tip laterally eared, densely papillate. Cephalic tentacles slender, tapered, prominent eyestalks with well developed eyes at outer bases. Neck lobes very prominent, thin, left lobe considerably larger than right, both occupying more than half length of (contracted) epipodial fringe. Epipodial tentacles small, tapered, 2 on each side.

Radula (Fig. 132) with the formula ∞ + 8 + 1 + 8 + ∞, generally similar to that of *C. (A.) granulatum*, which has only 5 pairs of lateral teeth at maturity.

REMARKS. — *Calliostoma (Ampullotrochus) alisi* bears a general similarity to *C. (Fautor) scobinatum* (Adams *in* Reeve, 1863) and *C. (F.) houbricki* sp. nov., but differs from both in colour and colour pattern, in being larger relative to the number of whorls, in having a larger protoconch (width 430 μm vs. 300 μm and 350-370 μm respectively), and in that S2 commences on the third teleoconch whorl. Despite these similarities to *Fautor* species, *C. (A.) alisi* exhibits gross teleoconch facies that are closer to *Ampullotrochus*, particularly the flattened early teleoconch whorls and strong, persistent axial sculpture. Moreover, the lateral radular teeth are not as slender as in *Fautor* species and more closely resemble those in *C. (A.) granulatum*, *heros* and *peregrinum*.

ETYMOLOGY. — After N.O. *"Alis"*.

Source : MNHN, Paris



FIGS 67-75. — Genera *Calliostoma (Ampullotrochus)* and *Bathyfautor*. — **67-69,** *Calliostoma (Ampullotrochus) alisi*, holotype, 14.7 × 12.7 mm, 68 × 15, 69 × 100. — **70**, *Bathyfautor rapuhia*, holotype, 22.8 × 17.7 mm. — **71-72**, *B. rapuhia*, paratype, Wanganella Bank, south of Norfolk Island, 757-660 m, NZOI P-950, 71 × 22, 72 × 116. — **73-75**, *B. coriolis*, holotype, 18.7 × 16.2 mm, 74 × 4, 75 × 21.

Genus ***Bathyfautor*** gen. nov.

Type species: *Bathyfautor rapuhia* sp. nov.; Recent, northern New Zealand.

DIAGNOSIS. — *Shell* up to about 23 mm high, white conical, anomphalous, periphery angulate, teleoconch whorls flat-sided. P3 commencing immediately. P1 and P2 commencing on 2nd and 3rd whorls respectively, or P1 and P2 commencing on 2nd and 1st whorls respectively. Teleoconch spirals

Source : MNHN, Paris

multiplying by intercalation: axials restricted to early whorls, strong between P3 and S3, intersections with conical nodules, spirals becoming smooth on later whorls in some species; base typically with a broad smooth median band. *Radula* with the formula ∞ + 5 + 1 + 5 + ∞, central tooth broad with broadly angulate tip, lateral teeth broad-based with narrowly tapered tips. Marginal teeth similar to those in *Calliostoma* (*s. lat.*). *Animal* with prominent left and right cephalic lappets extending posteriorly from eyestalks, otherwise similar to that in *Calliostoma* (*s. lat.*).

REMARKS. — Apart from the new species described below, this group includes *Calliostoma multispinosum* Schepman, 1908 (Indonesia and Philippine Islands), an undescribed species from off Rowley Shoals, Western Australia (NMNZ M 257425) and probably *Kombologion babelica* Habe, 1961 (southern Japan). Their shells are distinctive in being white with flat-sided whorls and an angulate periphery. Three of the species (described below) are rendered highly distinctive by the late appearance of P1 and P2, especially the latter, though these spirals appear earlier in the other species. *C. multispinosum* (holotype ZMA 3.08.74, plus 2 additional specimens in MNHN from MUSORSTOM 2 stations 44 and 77, off the Philippines) and the species described below share a distinctive smooth median basal spiral band. All of the species have particularly strong axial costae between P3 and S3 and exhibit a distinctive gross early teleoconch facies that is difficult to quantify or objectively describe — compare, for example, the illustrations of early teleoconchs of *Bathyfautor* species (Figs 71, 75, 77) with those of superficially similar *Ampullotrochus* and *Benthastelena* species (Figs 53, 56, 59, 62, 65, 68). The only well preserved animal seen (of *B. rapuhia* sp. nov.) differs from those of all other species examined during the present study in having prominent cephalic lappets that extend posteriorly from behind the bases of the eyestalks.

ETYMOLOGY. — From the Greek *bathus* (deep) and generic name *Fautor* (gender masculine).

Bathyfautor rapuhia sp. nov.

Figs 70-72, 133; Table 17

TYPE MATERIAL. — Holotype NZOI H-600. Paratypes: 3 NZOI, 1 NMNZ M117283, 1 MNHN.

TYPE LOCALITY. — N. New Zealand, NZOI stn U582, 31°52.0′ S, 172°26.0′ E, Three Kings Rise, 790-780 m, 5.2.1988, R.V. *"Rapuhia"*.

MATERIAL EXAMINED. — **New Zealand**. NZOI stn U582, 31°52.0′ S, 172°26.0′ E, Three Kings Rise, 790-780 m, 2 lv (holotype NMNZ).
Southern Norfolk Ridge. NZOI stn P8, 32°40.8′ S, 167°26.8′ E, Wanganella Bank, 757-660 m, 4 dd (paratypes: 3 NZOI, 1 MNHN).

DISTRIBUTION. — Three Kings Rise, northern New Zealand; and Wanganella Bank, southern Norfolk Ridge, 660-790 m, living at 780-790 m.

DESCRIPTION. — *Shell* up to 22.8 mm high, glossy, of moderate thickness, spire narrowly and rather evenly conical, 2.17-2.30x as high as aperture, mean spire angle 51-53°, anomphalous.

Colour uniform buff white, pale green nacreous layer showing through translucent outer layer in spiral interspaces.

Protoconch 470-500 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces, apical fold tip rounded, terminal varix strong.

Teleoconch of up to 8.90 whorls; 1st eighth whorl with crisp spiral threads, delineated by strong rounded varix and growth scar. First 2 whorls angulated at P3, subsequent whorls more or less flat, suture almost flush; periphery angulate, S3 peripheral; base weakly convex. Spire with prominent, rounded spiral cords that multiply by intercalation; axial costae strong on 1st 4 whorls, becoming obsolete on 5th whorl; nodules roundly conical, strongest at S3, gradually becoming obsolete after 4th - 6th whorl. P3 and P4 commencing immediately, P3 strong throughout; P1 commencing early on 2nd whorl, rapidly enlarging to resemble P3; P2 commencing on mid 3rd whorl, slowly enlarging to resemble P3; P4 weak throughout, partly covered by succeeding whorls. S1 and S2 enlarging to resemble adjacent primaries. S1 commencing early 5th - 6th whorl, S2 early 5th - 7th whorl, S3 mid - late 3rd whorl. Tertiary spiral commencing close to adapical side of S3 on mid 6th - 7th

Source : MNHN, Paris

whorl, another sometimes appearing on abapical side on mid 6th - late 7th whorl; adapical spiral largest, resembling summit of S3; additional tertiaries appearing on last few adult whorls, 1 per interspace. S3 and associated 1 or 2 tertiaries surmounting prominent peripheral bulge. Base with fine spiral threads between P4 and strong, rounded outer spiral cord; 3 or 4 smooth, rounded spiral cords on inner third; intermediate zone broad, smooth apart from few spiral threads beside outer cord, obscure spiral lines, and collabral growth lines. Aperture subquadrate. Outer lip thin at rim, modestly thickened within. Inner lip rather thick. Parietal glaze extremely thin.

Animal. Snout longer then broad, tip expanded and covered with crowded, slender papillae. Cephalic tentacles of moderate length, tapered, eyestalks with well developed eyes at outer bases. Cephalic lappets prominent, continuous with eyestalks. Neck lobes large, thin, right longer, left broader. Epipodial tentacles 4 on each side. Foot long and narrow, sides papillate. Operculum multispiral.

Radula (Fig. 133) with the formula ∞ + 5 + 1 + 5 + ∞. Central tooth broadest, tip broadly angulate, finely serrate. Lateral teeth broad-based, tips slender, finely serrate. Innermost pair of marginals very large, laterally compressed, terminal cusp largest, 3 or 4 stout subterminal cusps. Outer marginals narrowing outwards, tips narrowly tapered, outwardly more finely serrate. *Jaw* plates ovate, elements not markedly elongate anteriorly.

TABLE 17. — *Bathyfautor rapuhia*. Shell measurements (mm) and countings.

H	D	H/D	TW	
09.10	07.55	1.20	6.60	NZOI stn P8
19.50	15.50	1.26	8.75	NZOI stn P8
20.00	16.00	1.25	8.90	NZOI stn P8
22.80	17.70	1.29	8.80	Holotype

REMARKS. — Among previously described calliostomatines *Bathyfautor rapuhia* is extremely distinctive in the combination of large, narrowly conical, white shell, angulate periphery, flat-sided spire whorls, and especially the late appearance of P1 and P2. The unicarinate (P3) first teleoconch whorl is strikingly similar to those in Thysanodontinae, though the radula, jaw and early teleoconch microsculpture are entirely different.

ETYMOLOGY. — After R.V. "*Rapuhia*".

Bathyfautor caledonicus sp. nov.

Figs 76-78, 134, 157; Table 18

TYPE MATERIAL. — Holotype (11.5 × 10.4 mm, 6.80 TW) MNHN. Paratypes: 10 MNHN, 1 AMS C201709, 1 NMNZ M262479.

TYPE LOCALITY. — S. New Caledonia, BIOCAL, stn DW 48, 23°00′ S, 167°29′ E, 775 m.

MATERIAL EXAMINED. — **New Caledonia**, BIOCAL: stn DW 48, 23°00′ S, 167°29′ E, 775 m, 3 dd (holotype and paratypes: 1 MNHN, 1 NMNZ). — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 1 lv (paratype). — Stn DW 53, 23°09′ S, 167°43′ E, 975-1005 m, 1 dd.
MUSORSTOM 4: stn DW 159, 18°46′ S, 163°16′ E, 585 m, 2 dd (paratypes). — stn DW 160, 18°42′ S, 163°13′ E, 668 m, 5 lv (paratypes: 1 AMS, 4 MNHN). — stn DW 161, 18°39′ S, 163°11′ E, 550 m, 2 lv (paratypes).

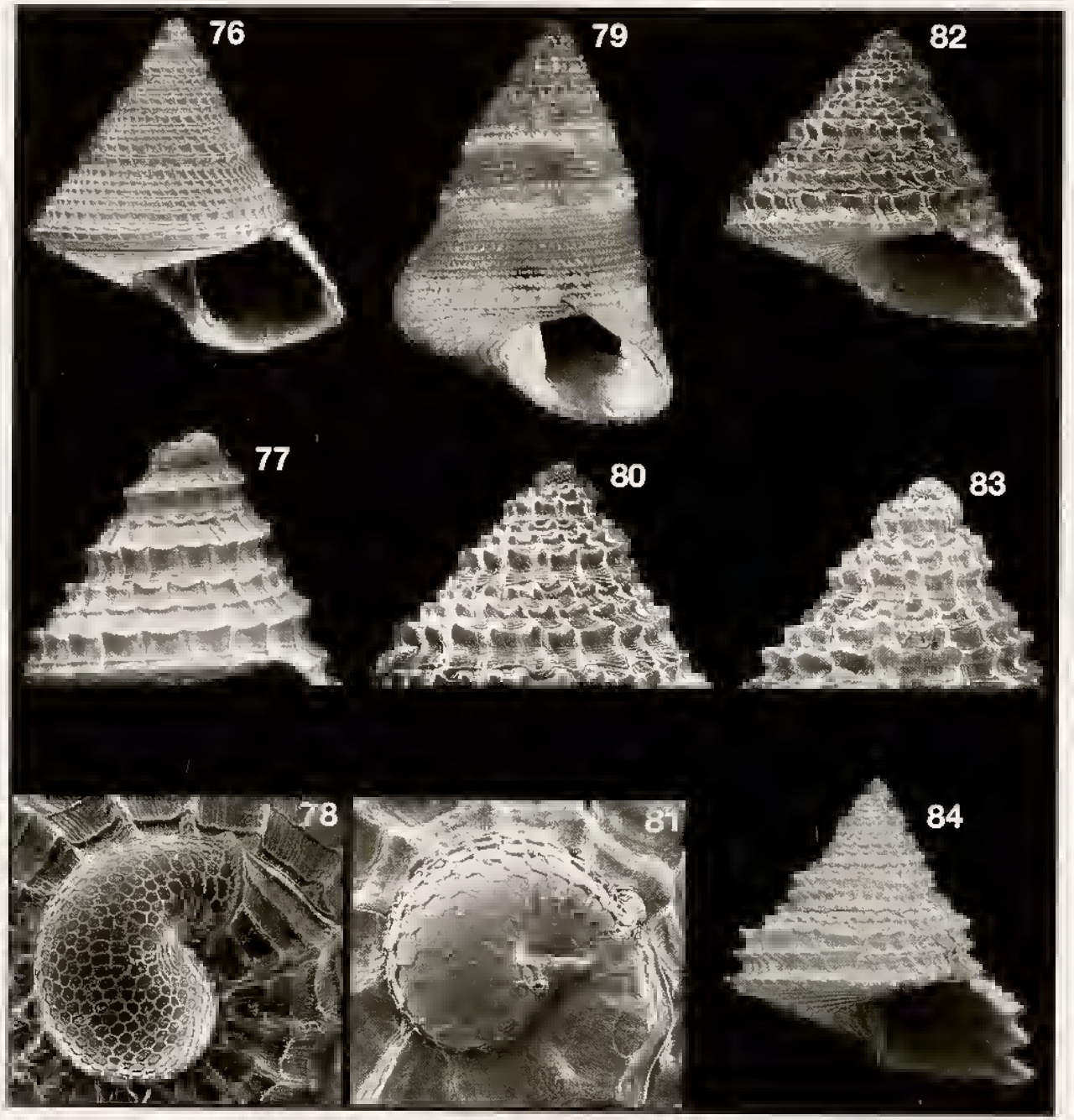
DISTRIBUTION (Fig. 157). — Grand Passage, northern New Caledonia and south of Ile des Pins, southern New Caledonia, 550-1005 m, living at 550-700 m.

DESCRIPTION. — *Shell* up to 11.5 mm high, glossy, of moderate thickness, spire narrowly and rather evenly conical, 1.53-1.88 × as high as aperture, mean spire angle 61-63°, very narrowly umbilicate.

Colour uniform white.

Protoconch 470-500 µm wide, sculptured with network of fine threads that enclose roughly hexagonal spaces, apical fold lip rounded, terminal varix prominent of up to 6.80 whorls; 1st eighth whorl with crisp spiral threads, delineated by strong rounded varix and growth scar. First 3 whorls

Source : MNHN, Paris



FIGS 76-84. — Genera *Bathyfautor*, *Dactylastele* and *Coralastele*. — **76**, *Bathyfautor caledonicus*, holotype, 11.5 × 10.4 mm. — **77-78**, *Bathyfautor caledonicus*, paratype, BIOCAL: stn DW 51, 77 × 20, 78 × 100. — **79**, *Dactylastele poupineli*, holotype, 11. 7 × 8. 40 mm. — **80-82**, *Dactylastele poupineli*, Senez Reef, Noumea Lagoon, New Caledonia, 3-6 m, MNHN, 3.90 × 4.20 mm, 80 × 22, 81 × 92. — **83**, *Coralastele allanae*, Murray Island, Queensland, intertidal, AMS C29298, × 60. — **84**, *Coralastele allanae*, Broadhurst Reef, Queensland, AMS C155293, 7.50 × 7.70 mm (immature).

angulated at P3, angulation weakening on 4th whorl, subsequent whorls flat or shallowly concave, suture weakly impressed; periphery angulate, S3 peripheral; base weakly convex, evenly curving into umbilicus. Spire with prominent, rounded spiral cords that multiply by intercalation; axial costae strong on 1st 4 whorls, weakening on 5th whorl; weak or obsolete thereafter, number and relative size variable after 3rd whorl, 26-45 on 5th whorl. Nodules roundly conical, shelved adapically, contiguous on S3 and P4. P3 and P4 commencing immediately after post larval scar, P3 strong throughout; P1 commencing early on 2nd whorl, rapidly enlarging to resemble P3; P2 commencing mid 2nd - mid 3rd whorl, enlarging to resemble P1 and P3; P4 weak throughout, partly covered by succeeding whorls. Secondary spirals enlarging to resemble primaries; S1 commencing mid - late 4th whorl, S2 commencing start 4th -late 5th whorl, S3

Source : MNHN, Paris

commencing mid 2nd - late 3rd whorl. Tertiary spiral commencing close to adapical side of S3 on mid 4th - early 6th whorl, usually another close to abapical side of S3 commencing late 5th - early 7th whorl, both remaining weak and resembling summit of S3 throughout. Other tertiary spirals commencing in varying orders at various stages of growth, remaining weaker than adjacent spirals, 1 per interspace. Basal spirals rounded, multiplying by intercalation, developing rounded nodules with increasing size, spirals either 9-11 and evenly distributed, or more or less obsolete from broad median zone. Fine collabral growth lines throughout. Aperture subquadrate. Outer lip thin at rim, little thickened within. Inner lip of moderate thickness; rim thin, overhanging umbilicus. Parietal inductura extremely thin.

Animal. External anatomy unknown (available animals dry).

Radula (Fig. 134) and *jaws* similar to those of *B. rapuhia*.

TABLE 18. — *Bathyfautor caledonicus*. Shell measurements (mm) and countings (BIOCAL: stn DW 48, MUSORSTOM 4: stns DW 159, DW 160, DW 161).

Character	*n*	Range	Mean	SD
H	9	06.30-11.50	8.40	1.69
D	9	06.05-10.40	7.83	1.43
H/D	9	01.00-01.14	1.07	0.04
TW	9	05.25-06.80	5.85	0.54

REMARKS. — Compared with *Bathyfautor rapuhia*, which it resembles in early teleoconch morphology, *B. caledonicus* differs in being more broadly conical (mean spire angle 61-63° instead of 51-53°), in lacking a peripheral bulge, and in that the nodules do not become obsolete on later whorls. There is considerable variation in the relative size and number of axial costae after the third teleoconch whorl, specimens with narrower, more crowded axials tending to have smaller more sharply pointed nodules. Although the samples are too small for statistical purposes, most specimens from northern New Caledonia have more numerous axial costae than southern specimens, the latter including the holotype (number of axials on 5th teleoconch whorl: range 26-45, mean 37.3, SD 6.56, $n=6$, as against range 28-35, mean 30.6, SD 3.78, $n=3$). Since there appear to be no other correlated differences between coarsely and finely sculptured specimens, all of the material is considered to represent a single polymorphic species.

ETYMOLOGY. — New Caledonian.

Bathyfautor coriolis sp. nov.

Figs 73-75, 154

TYPE MATERIAL. — Holotype (18.7 × 16.2 mm, 8.90 TW) and 2 paratypes MNHN.

TYPE LOCALITY. — Chesterfield Islands, MUSORSTOM 5, stn DC 357, 19°37′ S, 158°46′ E, 630 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn 357, 19°37′ S, 158°46′ E, 630 m, 1 dd (holotype).
CORAIL 2: stn DE 13, 21°03′ S, 160°55′ E, Lansdowne Bank, 700-705 m, 1 dd (paratype). — Stn DE 14, 21°01′ S, 160°57′ E, Lansdowne Bank, 650-660 m, 1 dd (paratype).

DISTRIBUTION (Fig. 153). — Off Chesterfield Islands (type loc.) and Lansdowne Bank, 630-705 m (dead).

DESCRIPTION. — *Shell* up to 22.0 mm high, glossy, lightly-built, spire narrowly conical, weakly coeloconoid, 2.28-2.34x as high as aperture, mean spire angle 56°, very narrowly umbilicate.

Colour uniform white.

Protoconch 480-500 µm wide, sculptured with network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip rounded, terminal varix strong.

Teleoconch of up to 9.60 whorls; 1st eighth whorl with 5 crisp spiral threads, delineated by growth scar and strong, rounded

Source : MNHN, Paris

varix. First whorl angulated at P3, next whorl weakly convex, subsequent whorls flat, suture almost flush; periphery angulate, S3 peripheral; base weakly convex, evenly curving into umbilicus. Spire with prominent rounded spiral cords that multiply by intercalation, nodules roundly conical; axial costae strong on 1st 3 whorls, becoming obsolete on 4th whorl. P3 and P4 commencing immediately after post larval scar, P3 strong; P1 commencing early on 2nd whorl, rapidly enlarging to resemble P3; P2 commencing at start of 3rd whorl, remaining weaker than P1 and P3; P4 weak throughout. S3 commencing mid 3rd whorl, becoming as large as P1 and P3. Tertiary spiral commencing adapically beside S3 on late 4th - 5th whorl; another abapically on mid 6th - late 8th, whorl resembling summit of S3 throughout, additional tertiaries intercalating between P3 and S3. P1-P3 weakening on 5th whorl, P1 becoming obsolete on 6th or 8th whorl, P2 on 5th whorl; P3 on 7th or 8th whorl; last few adult spire whorls smooth apart from S3 and associated 2 tertiaries, some additional fine tertiaries mainly on abapical third, obscure spiral lines, and fine collabral growth lines; last half of last adult whorl finely lirate throughout. Base with crowded lirae between P4 and low, smooth, rounded outer spiral cord; 2 or 3 strong, rounded, widely spaced, weakly nodular spiral cords beside umbilicus; elsewhere smooth apart from obscure spiral lines and collabral growth lines; last half of last adult whorl lirate throughout. Aperture subquadrate. Outer lip thin at rim, modestly thickened within. Inner lip of moderate thickness; rim thin, overhanging umbilicus. Parietal inductura extremely thin.

Animal unknown.

REMARKS. — *Bathyfautor coriolis* differs from both *B. rapulia* and *B. caledonicus* in the obsolescence of spire spirals other than S3 and P4 on late teleoconch whorls. It differs further in being more broadly conical than *B. rapulia* and more narrowly conical than *B. caledonicus* (mean spire angles respectively 56°, 51-53°, and 61-63°).

ETYMOLOGY. — After N.O. "*Coriolis*".

Genus *DACTYLASTELE* gen. nov.

Type species: *Trochus (Zizyphinus) poupineli* Montrouzier 1875; Recent, tropical western Pacific.

DIAGNOSIS. — Shell stout, anomphalous, up to 13 mm high, periphery rounded at maturity, spire whorls weakly convex. Protoconch apical fold tip tightly pinched. Spiral cords of moderate size, nodular. P1-P4 very rapidly enlarging on 1st teleoconch whorl, P4 strongly nodular, especially on early whorls, spiral interspaces on spire spirally lirate throughout or (in *duplicatus*) non-lirate. Periostracum thin, smooth, simple.

REMARKS. — *Dactylastele* is introduced for a compact group of species comprising *Trochus poupineli* Montrouzier, 1875 (tropical western Pacific), *Calliostoma burnupi* Smith, 1899 (southern Africa), *C. nevilli* Sowerby, 1905 (Sri Lanka), and *Zizyphinus duplicatus* A. Adams, 1851 (described from unknown locality, several lots of conspecific material examined from Bombay — syntypes BMNH 196846). All of these are highly distinctive in the very rapid enlargement of P1-P4 on the first teleoconch whorl, in having P4 strongly nodular on the earliest teleoconch whorls, and in having an unusual colour pattern comprising a narrow yellowish brown line in each spiral interspace. With the exception of *Z. duplicatus*, which is otherwise similar, these are further strongly characterised by the presence of fine interstitial spiral lirae.

Dactylastele is undoubtedly closely related to *Coralastele* Iredale, 1930 (type species *C. allanae* Iredale, 1930, Queensland — Figs 83-84), their species sharing similar protoconchs, strongly nodular P4 on early teleoconch whorls, spirally lirate interspaces, and fundamentally similar radulae. The distinctive radula has 7 pairs of slender lateral teeth with narrowly tapered, serrated tips; and slender narrow-based innermost marginal teeth that are little stronger than the adjacent marginals.

Dactylastele species differ from species of *Coralastele* in being anomphalous at maturity, in attaining smaller maximum size (shell height 13 mm instead of 21 mm), and in having substantially weaker spiral cords on later whorls. Moreover, the periostracum in *Coralastele* species is spirally flanged on the spiral cords and strongly axially laminar between the nodules, while it is thin, smooth and simple in *Dactylastele*. *Dactylastele* species differ further in that the predominant shell colour pattern is confined to the spiral interspaces rather than to the spiral cords as in *Coralastele*.

Source : MNHN, Paris

Dactylastele and *Coralastele* species are among the very few calliostomatids that occur in the littoral or shallow sublittoral in the tropical and subtropical Indo-Pacific.

Apart from the type species, taxa referable to *Coralastele* include *Gibbula punctocostata* A. Adams, 1853 (Philippines), *Eutrochus pulcherrimus* Sowerby, 1914 (southern Japan and Okinawa), and an undescribed species from Norfolk Island (AMS, NMNZ). The type specimens of *G. punctocostata* and *E. pulcherrimus* (BMHN 196896 and 1915.1.6.182 respectively) differ from each other and from the syntypes (AMS C57742) and topotypes of *C. allanae* in minor details, though I have seen insufficient additional material to ascertain the constancy of these differences. While they may well all represent local populations of a single polymorphic species, I am presently disinclined to suggest that they are synonyms.

ETYMOLOGY. — From the Greek *Daktylios* (ring) and generic name *Astele*, alluding to the distinctive colour pattern (gender feminine).

Dactylastele poupineli (Montrouzier, 1875)

Figs 79-82, 135, 155

Trochus (Zizyphinus) poupineli Montrouzier *in* SOUVERBIE & MONTROUZIER, 1875: 40, pl. 4, fig. 6.

Other references:

Trochus poupineli — FISCHER, 1879: 387, pl. 116, fig. 3.
Calliostoma poupineli — PILSBRY, 1890: 350, pl. 17, fig. 41.
Calliostoma (Fautor) poupineli — IREBE, 1942: 274, pl. 28, figs 12a-b.
Fautor poupineli — HABE, 1961: 9, pl. 5, fig. 1; 1964: 13, pl. 5, fig. 1.
NOT *Calliostoma poupineli* — THIELE, 1930: 565 (= *Calliostoma (Fautor)* cf. *comptum* (A. Adams, 1854).

TYPE MATERIAL. — Holotype, Muséum d'Histoire Naturelle de Bordeaux, France.

TYPE LOCALITY. — Northern New Caledonia, Ile Art.

MATERIAL EXAMINED (62 specimens). — **Japan**. Off Kyoto, 6 dd (5 LACM, 1 NMNZ). — Off Kii, 1 dd (LACM). — Tosa Bay, 91 m, 3 dd (USNM). — Okinawa, 2 dd (NSMT).
Philippines. Off Masoinit Is., Palawan, 2-6 m, 1 lv (LACM).
Queensland. Murray I., Torres Strait, in crevices of madrepore, 3 lv (AMS). — Off inner side of Carter Reef, 18 m, 15.1.1980, W.F. Ponder, 1 dd (AMS). — Low Isles, Nov 1928, T. Iredale, G.P. Whitley & A. Livingstone, 2 dd (AMS). — Michaelmas Cay, May-June 1926, T. Iredale & G.P. Whitley, 1 dd (AMS). — Little Upolu Cay, off Cairns, intertidal, 19.7.1970, I. Loch, 1 dd (AMS). — Little Broadhurst Reef, off Townsville, subtidal, 14.4.1974, I. Loch, 1 lv (AMS). — Off W side Gillett Cay, Swains Reef, 64-73 m, 17-19.10.1962, 2 dd (AMS). — Off North West I., off Yeppoon, 31 m, T.A. Garrard, 1 dd (AMS). — North West I., 5.1931, T. Iredale, M. Ward & G.P. Whitley, 1 dd (AMS). — Barren I., Yeppoon, 8 m, 12.1972, N. Coleman, 2 lv (AMS). — Off Masthead I., Capricorn Group, 31-37 m, 25-29.10.1904, C. Hedley, 1 dd (AMS). — Mooloolabah, N of Caloundra, N. & V. Gomersal, 1 dd (AMS). — Shelley Beach, Caloundra, beach, J. Voorwinde, 1 dd (AMS).
Lord Howe Island. R.S. Bell (25 specimens in 4 lots AMS).
New Caledonia. 22°17.95′ S, 166°19.57′ E, Senez Reef, Noumea Lagoon, 3-6 m, P. Bouchet and B.A. Marshall, 23.11.1992, 3 lv (MNHN).
"*Vauban*" 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 3 dd (MNHN).
Loyalty Islands. Lifu, C. Hedley (1 AMS). — J. Brazier, 1 dd (AMS).
Fiji. Levuka, Ovalau, 10.1919, W.R.B. Oliver, 1 dd (NMNZ).

DISTRIBUTION (Fig. 155). — Japan, Okinawa, Philippines, Queensland, Lord Howe Island, New Caledonia, Loyalty Islands, Fiji, intertidal to 350 m, living intertidally to 8 m amongst coral.

Source : MNHN, Paris

DESCRIPTION. — *Shell* (New Caledonian specimens) up to 11. 7 mm high, glossy. stout; spire narrowly conical, very weakly cyrtoconoid. 2.17x as high as aperture; mean spire angle 51°. anomphalous.

Colour of tip of apical fold reddish brown, protoconch elsewhere colourless and translucent. Subsequent whorls buff while, spiral interspaces on spire each with fine yellowish brown spiral line, P4 spotted yellowish brown. base buff while.

Protoconch 300 μm wide, sculptured with network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip narrowly tapered, terminal varix strong.

Teleoconch of up to 6.60 whorls, no post larval growth scar or varix. First whorl convex, subsequent whorls almost flat. suture essentially flush; periphery angulated at P4, tightly rounded on last adult whorl; base weakly convex. Spiral cords on spire and base prominent. multiplying by intercalation; axial costae strong on 1st 3 whorls, almost obsolete thereafter. P1-P4 commencing immediately; P1 commencing later than P2, rapidly enlarging to resemble P2 by end of 1st whorl; P3 and P4 stronger than P1 and P2 throughout; P4 almost entirely exposed on spire. Secondary spirals enlarging to resemble P1 and P2, S1 commencing mid 4th whorl, S2 commencing early 4th whorl, S3 absent. Tertiary spirals remaining weaker than primaries. one commencing mid 5th whorl between suture and P1, another commencing late 5th whorl between P2 and S2. Nodules roundly conical on spire, strong on P3 and P4 on 1st 3 whorls, becoming irregular in size on P3 and P4 from mid 3rd whorl, the largest nodules larger than those on other spirals. Base with 13 similar, rounded spiral cords with small rounded nodules. Spiral interspaces on all spire whorls with crowded spiral lirae, fine collabral growth lines throughout. Aperture subquadrate. Outer lip thin at rim, rather strongly thickened within. Inner lip thick. Parietal inductura extremely thin.

Animal. External anatomy unknown (available material dry).

Radula (Fig. 135) with the formula ∞ + 7 + 1 + 7 + ∞. Innermost marginal slender. little stouter than adjacent marginals and not as strongly differentiated from them as in most other Calliostomatinae. Radula otherwise rather similar to those in *Calliostoma* (*s. lat.*), as is *jaw*.

REMARKS. — *Dactylastele poupineli* is highly distinctive in the combination of very rapid development of P1-P4 on the first teleoconch whorl, the strong nodules on P4, the fine interstitial spiral lirae, and the colour pattern. *Dactylastele poupineli* is one of the most widely distributed calliostomatids in the western Pacific. which suggests that is has a free-floating larval stage (lecithotrophic) of exceptionally long duration.

Calliostoma (Fautor) comptum has been frequently treated as a synonym of *D. poupineli* (*e.g.* FISCHER, 1879; IKEBE, 1942; HABE, 1961; KOSUGE, 1984), although they actually differ in numerous details of colour pattern, sculpture and radular morphology. Their protoconchs are, moreover, quite different in sculpture (Fig. 6 vs. Fig. 81) and size (width 500 μm in *C. comptum*). As suggested by BRAZIER (1895), and supported by HEDLEY (1913: 279). ADAMS (1855) erred in recording *C. comptum* from New Caledonia, since the syntypes (BMNH 1968177) are indistinguishable from the narrow New South Wales form of the species, which is widely distributed in southern Australia and unknown from elsewhere.

Genus *LAETIFAUTOR* Iredale, 1929

Laetifautor Iredale, 1929: 271. Type species (OD): *Calliostoma trepidum* Hedley, 1907 (= *Calliostoma deceptum* Smith, 1899); Recent, northern Australia.

Synonym:

Spicator Colton & Godfrey, 1935: 14. Type species (OD): *Calliostoma spinulosum* Tate, 1893; Recent, southern Australia. **(Syn. nov.).**

DIAGNOSIS. — *Shell* up to 9 mm high, anomphalous, stout, higher than broad at maturity. Protoconch sculpture network very widely open. Teleoconch spirals strong to very strong, axials strong and persistent throughout, strong sharp nodules at intersections. *Radula* with the formula ∞ + 1 + 1 + 1 + ∞. Central and lateral teeth extremely slender with hair-like serrated tips, tightly cramped between bases of massive innermost marginals. Marginals relatively fewer in number per tranverse row than in most other calliostomatine groups, inner teeth with enlarged terminal cusp.

REMARKS. — The type species of *Laetifautor* (Fig. 90) and *Spicator* (Fig. 86) have essentially similar shell and radular morphologies (Figs 136-137) and it is impossible to justify segregation of *Spicator* from the prior *Laetifautor*. Apart from the Australian type species. the genus includes *Zizyphinus rubropunctatus* A. Adams, 1851 (Queensland, southern Japan, Okinawa, Ryukyu Islands and Philippines), an undescribed species from off the Philippine Islands (NMNZ M257491), and *L. fimdatus* sp. nov. from New Caledonia (see below).

Source : MNHN, Paris

As a group *Laetifautor* is extremely distinctive in the combination of small shell size, strong teleoconch sculpture and highly reduced number of radular teeth.The adult radula in *Laetifautor* is strikingly similar to those of juvenile calliostomatines with otherwise typical adult radulae (see WARÉN. 1990: 180, 186, fig. 6C). Thus development of the radula is retarded through paedomorphosis. as is also probably the teleoconch, since the juvenile and adult facies are strikingly similar.

Laetifautor fundatus sp. nov.

Figs 85. 87, 89, 157

TYPE MATERIAL. — Holotype (6.00 × 4.60 mm, 5.50 TW) MNHN.

TYPE LOCALITY. — S. New Caledonia, LAGON, stn 133, 22°24′ S, 166°52′ E, 59-62 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION (Fig. 157). — Off southern New Caledonia, 59-62 m (dead).

DESCRIPTION. — *Shell* (holotype) 6.00 mm high, glossy, very stout; spire narrowly conical, 2.00x as high as aperture, weakly cyrtoconoid; mean spire angle 55°, anomphalous.

Colour pale yellowish brown, small reddish brown spots between spirals and axials on spire and base.

Protoconch 400 μm wide, sculptured with network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip rounded, terminal varix strong.

Teleoconch of 5.50 whorls; 1st eighth whorl with fine, crisp spiral threads, delineated by strong, rounded varix and growth scar. Whorls convex, 1st whorl most strongly so, P3 peripheral; base rather sharply retracted below P4, periphery becoming rounded on last adult whorl; base weakly convex. Spiral cords and axial costae rounded, strong, similar and similarly spaced on spire, weaker on base. P2-P4 commencing immediately after post larval scar, P2 and P3 strong and similar throughout; P1 commencing on mid 1st whorl, becoming strong though remaining weaker than P2 and P3; P4 almost entirely exposed on spire, weakest. S3 commencing late on 2nd whorl close beside P4, becoming more prominent than P4 though remaining weaker than P1; S1 commencing late on last adult whorl, weak. Nodules on spire roundly conical, prominent on P1, very prominent on P2 and P3, blunter on P4. Base with 2 weak spiral cords close beside P4; followed by 6 strong, rounded spiral cords with low, rounded nodules, outermost spiral strongest, a weak secondary spiral on its inner side. Aperture subquadrate. Outer lip rapidly and very strongly thickened within. Inner lip thick. Parietal inductura thin.

Animal unknown.

REMARKS. — This species is extremely distinctive in its small size, colour pattern, prominent nodules, and strong spiral and axial sculpture on the spire. It is obviously closely related to *L. rubropunctatus* (A. Adams, 1853). which it resembles in general shell facies, including the colour pattern on the spire. Compared with the holotype of *L. rubropunctatus* (BMNH 196842) and specimens from Okinawa (2 lots LACM), Mindanao, Philippine Islands (1 lot LACM). and Queensland (6 lots AMS). *L. fundatus* differs in having blunter, less prominent nodules, especially on S3, a larger protoconch (width 400 μm vs. 300-320 μm). and pigment spots in the interspaces of the basal spirals instead of on the summits of the spiral cords.

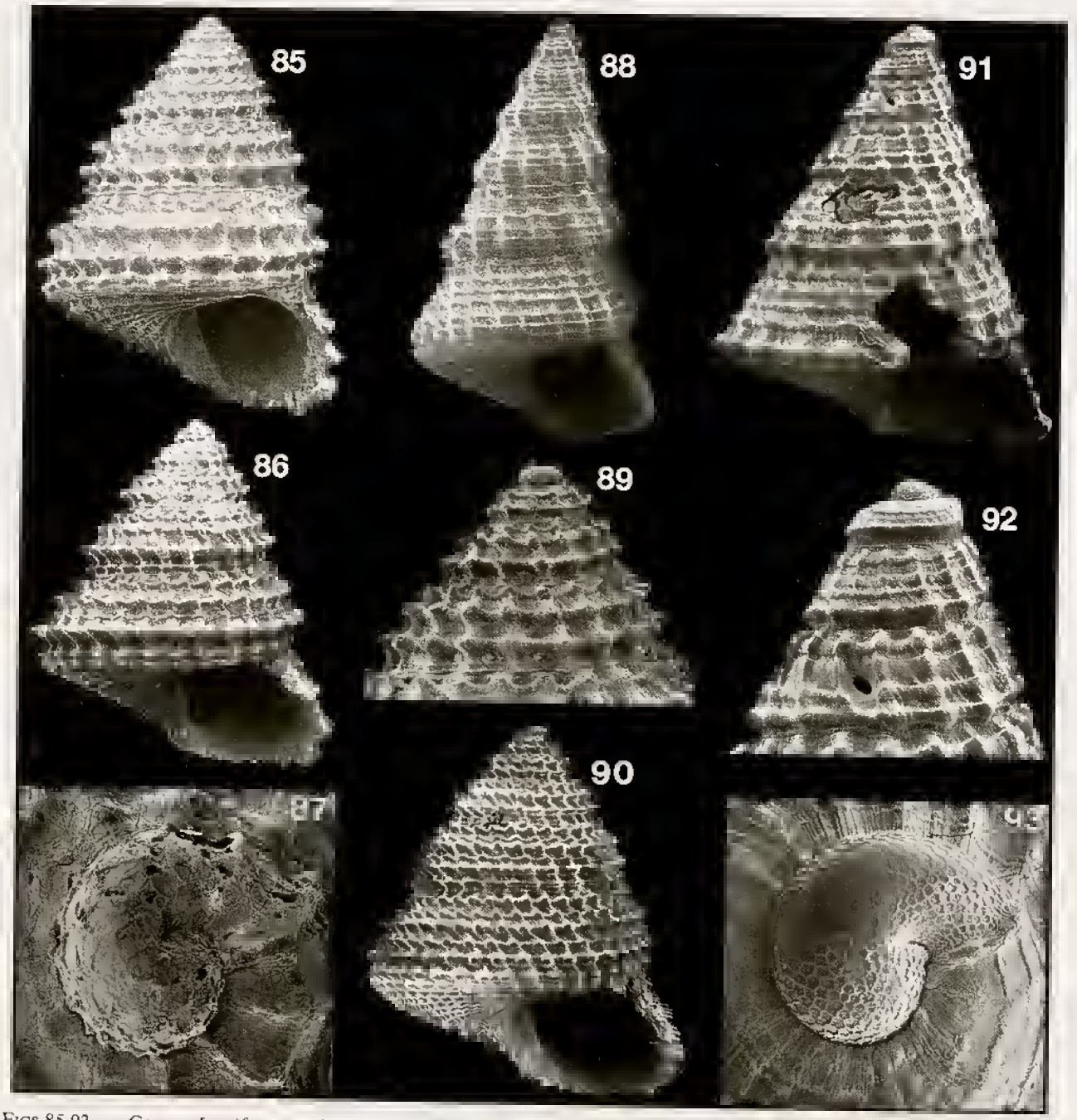
ETYMOLOGY. — From the Latin *fundatus* (firm, grounded).

Genus *SELASTELE* gen. nov.

Type species: *Calliostoma onustum* Odhner, 1924: Recent, northern New Zealand.

DIAGNOSIS. — *Shell* up to 9.80 mm high, spire narrowly conical, anomphalous. P2 and P3 commencing immediately, P1 enlarging slowly on 1st 1 or 2 whorls, axial sculpture strong and persistent. *Radular* formula ca. 10 + 8 + 1 + 8 + ca. 10. Marginal 1 relatively small, stout; central and lateral teeth very long and narrowly tapered, exceedingly thin in section.

Source : MNHN, Paris



FIGS 85-93. — Genera *Laetifautor* and *Selastele*. — **85**, **87**, **89**, *Laetifautor fundatus*, holotype, 6.00 × 4.60 mm, 87 × 72, 89 × 23. — **86**, *Laetifautor spinulosus*, Moonta Bay, South Australia, South Australian Museum D18836, 5.80 × 5.10 mm. — **88**, *Selastele onustum*, off Three Kings Islands, northern New Zealand, 128 m, NMNZ M34251, 9.85 × 5.50 mm. — **90**, *Laetifautor trepidus*, off Swain's Reef, Queensland, 100 m, AMS C154363, 6.15 × 4.85 mm. — **91-93**, *Selastele pictum*, holotype, 5.45 × 4.20 mm, 92 × 38, 93 × 116.

REMARKS. — The type species of *Selastele* (Fig. 88) is very distinctive in the combination of small shell size, narrowly conical spire and unusual radula. The radula (Figs 138-139) has fewer marginal teeth per transverse row and a relatively weaker innermost marginal than any known calliostomatid other than thysanodontines, which, however, have entirely different tooth and early teleoconch morphologies. In contrast, the number of lateral teeth (8 pairs per transverse row) is

Source : MNHN, Paris

exceptionally high for a calliostomatid of this size, although there are more numerous laterals in a few (larger) species, such as *Venustatrochus georgianus* Powell, 1951. While the number of laterals is high, overall development of the radula in *Selastele* is retarded, evidently as the result of a paedomorphic process. One of two undescribed species from New Zealand (NMNZ) has an even more weakly developed radula, a sub-adult with 4.5 teleoconch whorls having teeth that are almost gelatinous. The group is represented in southern Australia by the Recent species *Calliostoma retiarium* Hedley & May, 1908.

ETYMOLOGY. — From the Greek *selasma* (shining) and generic name *Astele* (neuter).

Selastele pictum sp. nov.

Figs 91-93, 158

TYPE MATERIAL. — Holotype (5.45 × 4.20 mm, 6.10 TW) MNHN.

TYPE LOCALITY. — S. Loyalty Islands, SMIB 5, stn DW 87, 22°19′ S, 168°41′ E, 370 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION (Fig. 158). — Southern Loyalty Islands, dead, 370 m.

DESCRIPTION. — *Shell* (holotype) 5.45 mm high; spire narrowly and evenly conical, 2.7 × as high as aperture, mean spire angle 50°; anomphalous.

Colour. Protoconch white; first half teleoconch whorl orange, following 3.5 whorls with orange spots on P3, elsewhere translucent white, brilliantly nacreous though thin translucent outer shell layer.

Protoconch 350 μm wide, sculptured with dense network of fine, crisp threads that enclose roughly hexagonal spaces. Extreme tip of apical fold tightly pinched, terminal varix strong.

Teleoconch of 6.10 whorls; 1st tenth whorl sculptured with crisp spiral threads and minute granules, sharply delineated by growth scar. First whorl convex, subsequent whorls flat, periphery angulate, base flat. Sculpture of rounded spiral cords that multiply by intercalation and gradually enlarge, and persistent axial costae; rounded nodules at intersections. P1, P2, S2, P3 and P4 commencing immediately; P2 and P3 strong and similar on 1st 1.5 whorls, after which P2 widens and weakens, becoming obsolete early on 3rd whorl; P3 peripheral, strongest throughout. P1 and S2 commencing as fine threads, both rapidly enlarging on 2nd whorl to become almost as large as P3, similar throughout. Late on 3rd whorl 2 tertiary spirals resolve between P1 and S2 in space formerly occupied by P2, then rapidly enlarge to resemble P1 and S2. P4 weak throughout, almost entirely covered by succeeding whorls. A tertiary spiral intercalating between S2 and P3 late on last adult whorl. Base with 8 similar spiral cords that are weaker and more weakly nodular than spire spirals; a weak tertiary spiral between outermost spiral and P4. Axial costae weak and crowded on 1st half whorl, thereafter strong on spire and weak on base with interspaces wider than each axial; collabral on 1st whorl and on base, non-collabral to varying degrees on subsequent whorls. Fine collabral growth lines throughout, prosocline on spire, opisthocyrt on base. Aperture subquadrate. Inner lip of moderate thickness, almost orthocline, parietal glaze very thin, outer lip rim broken back, thin.

Animal unknown.

REMARKS. — Compared with *Selastele pictum*, the southern Australian species *S. retiarium* differs in having P2 stronger and persistent throughout, with P3 also stronger and set higher on each whorl. Apart from several sculptural details, the New Zealand type species (Fig. 88) differs in having each teleoconch whorl concave on the adapical half and convex abapically.

ETYMOLOGY. — Painted (Latin).

TRIBE FAUTRICINI nov.

Type genus: *Fautrix* gen. nov.

DIAGNOSIS. — First teleoconch whorl with strong spiral lirae and crowded axial riblets. Teleoconch whorls convex, sculptured with spiral cords that multiply by intercalation, and axial riblets that become obsolete on later whorls. Spire spirals nodular, basal spirals nodular or smooth. Narrowly umbilicate. Aperture simple. Head very broad, snout broadly rounded in front. Foot short

Source : MNHN, Paris

and broad, folded from end to end when retracted. Radular formula ∞ + 8-9 + 1 + 9-8 + ∞. Central and lateral teeth narrowly elliptical, thin in section, faces concave, tips pointed and non-serrate. Lateral teeth apparently multiplying during ontogenesis by progressive morphological transformation of marginal teeth. Marginal teeth in early ontogenesis all long and thin in section, with broad, blunt, finely serrate tips. In later ontogenesis inner 9 pairs of marginal teeth becoming progressively stouter and vertical cutting area with strong cusps forming on inner edges, terminal cusp becoming progressively larger relative to subterminal cusps.

REMARKS. — This new tribe is introduced for *Fautrix* gen. nov., the type species of which (see below) differs markedly from all other known calliostomatids in having a much broader head, a shorter and broader foot that when retracted is folded from end to end instead of from side to side, and an entirely unique radular ontogenesis and morphology. Unique features of the radula include the elliptical, cuspless central and lateral teeth, the morphologically sharply differentiated inner and outer marginal teeth, the very stout inner marginal teeth, and the blunt-tipped outer marginal teeth. Other unique features of the radula are the similarity of the inner 9 pairs of marginal teeth, and the relatively small innermost marginal. By contrast all other calliostomatids have a single enlarged innermost pair of marginals, while the outer teeth exhibit a rather smooth outward morphological gradation. The most remarkable and significant features of the radula, however, are the apparent formation of lateral teeth by transformation of marginals and the profound morphological changes in marginal tooth morphology into late ontogenesis.

As recently demonstrated by WARÉN (1990), the innermost marginal in Calliostomatinae becomes greatly enlarged at a very early stage of development and prior to formation of the central and lateral teeth. He showed that the lateral teeth arise pair by pair through intercalation within the central field, unlike all other known trochoideans in which laterals are multiplied by progressive morphological transformation of marginal teeth. In a study of four calliostomatine species, WARÉN (1990) found that the central tooth and first pair of laterals were formed when specimens had 1.5-3 teleoconch whorls and that the other lateral teeth appear rather abruptly when the shell has 3.5-4.5 teleoconch whorls. Apart from a progressive increase in the number of teeth, there is relatively little change in marginal tooth morphology between juveniles with 0.5 teleoconch whorls and adults in these species (WARÉN, 1990: figs 6 A-D). Since there can be no doubt that the calliostomatine radula is derived from a standard trochoidean plan, it is concluded that the radula in *Fautrix* is more primitive than that in Calliostomatinae (plesiomorphic) and that Fautricini either represents the common basal stock or is an offshoot from it.

Fautricini is here interpreted as a grade of lower calliostomatines rather than as a discrete phylogenetic radiation, for which the category of subfamily would be more appropriate.

Fautrix species are living representatives of a group of (undescribed) genera that were richly speciated in the Miocene of Australia. These exhibit an astonishing variety of bizzare shell shapes and sculptural types that have no parallel among hitherto known calliostomatids (descriptions in prep.).

Genus *FAUTRIX* gen. nov.

Type species: *Fautrix candida* sp. nov.

DIAGNOSIS. — As for the tribe.

REMARKS. — The shells of *Fautrix* species bear a general resemblance to that of the Japanese species *Calliostoma (Calotropis?) akoya* Kuroda, 1942, type species of *Akoya* Habe, 1961. *Fautrix* species differ, however, in numerous details of teleoconch sculpture, while the radula of *Akoya akoya* is typically calliostomatine and essentially similar to that in *Benthastelena*. *Akoya* may be related to *Otukaia* Ikebe, 1942 but, it might also be a deep water representative of the group typified by *Calliostoma* (*s. lat.*) *unicum* (Dunker, 1860). See under subfamily diagnosis for additional remarks.

ETYMOLOGY. — Patroness (Latin) (gender feminine).

Source : MNHN, Paris

Fautrix candida sp. nov.

Figs 94-96, 98, 140-147, 157; Table 19

TYPE MATERIAL. — Holotype and 2 paratypes MNHN.

TYPE LOCALITY. — S. New Caledonia, SMIB 4, stn DW 60, 23°00′ S, 167°22′ E, S. New Caledonia, 500-535 m.

MATERIAL EXAMINED. — **New Caledonia**. SMIB 4: stn DW 60, 23°00′ S, 167°22′ E, 500-535 m, 1 lv (holotype). — Stn DW 61, 23°00′ S, 167°22′ E, 520-550 m, 1 dd (paratype).
CHALCAL 2: stn DW 76, 23°41′ S, 167°45′ E, 470 m, 1 lv (paratype).
S. Norfolk Ridge. NZOI stn 196, 32°10.8′ S, 167°21.2′ E, Wanganella Bank, 356 m, 25.7.75, R.V. "*Tangaroa*", 1 lv (NZOI).
N. New Zealand. Off Three Kings Islands (ca.100 specimens in 7 lots NMNZ).

DISTRIBUTION (Fig. 157). — Off southern New Caledonia (470-550 m), Wanganella Bank, southern Norfolk Ridge (356 m), and off Three Kings Islands, northern New Zealand (200-805 m), living at 206-535 m.

DESCRIPTION. — *Shell* up to 14.0 mm high, glossy, thin, spire broadly conical, weakly cyrtoconoid 0.93-1.19x as high as aperture, mean spire angle 70-77°, very narrowly umbilicate, translucent white.

Protoconch 400-420 µm wide, sculptured with dense network of fine crisp threads that enclose roughly hexagonal spaces, apical fold tip broadly rounded, terminal varix strong.

Teleoconch of up to 5.00 whorls; 1st eighth whorl with crisp spiral threads and strong rounded varix, delineated by growth scar. Whorls strongly convex, periphery rounded; base weakly convex, evenly rounded into umbilicus at maturity. Spiral cords prominent, multiplying by intercalation, stronger on spire than on base; spire spirals with rounded nodules, P4 smooth, inner few basal spirals with rounded nodules, most outer basal spirals becoming weakly or very weakly nodular at maturity. Axial riblets fine, crisp and crowded on 1st half whorl, progressively enlarging and becoming more widely spaced over next full whorl, weakening over next half whorl, becoming obsolete on 3rd whorl. P1-P4 commencing immediately after post larval scar, P2-P4 similar throughout; P1 weaker on 1st whorl, rapidly enlarging to resemble P2-P4; P4 partly covered by succeeding whorls. Secondary spirals enlarging to resemble primaries. S1 commencing immediately or early - late 3rd whorl, S2 commencing late 2nd - late 3rd whorl, S3 commencing early 3rd - early 4th whorl; additional spirals intercalating at varying positions and orders after 2nd whorl, enlarging to resemble primaries. Base with 8-10 major spiral cords in front of parietal area, others intercalating. Fine collabral growth lines throughout. Aperture subcircular. Outer lip thin at rim, slightly thickened within. Inner lip thick. Parietal inductura extremely thin.

Animal. Head very broad, snout broadly rounded in front, fringed with crowded slender papillae. Cephalic tentacles of moderate size, tapered, prominent eyestalks with developed eyes at outer bases. Cephalic lappets small, connected to and extending posteriorly from eyestalks. Left and right neck lobes large, broad. Epipodial tentacles 3 on each side. Foot broad and extremely short.

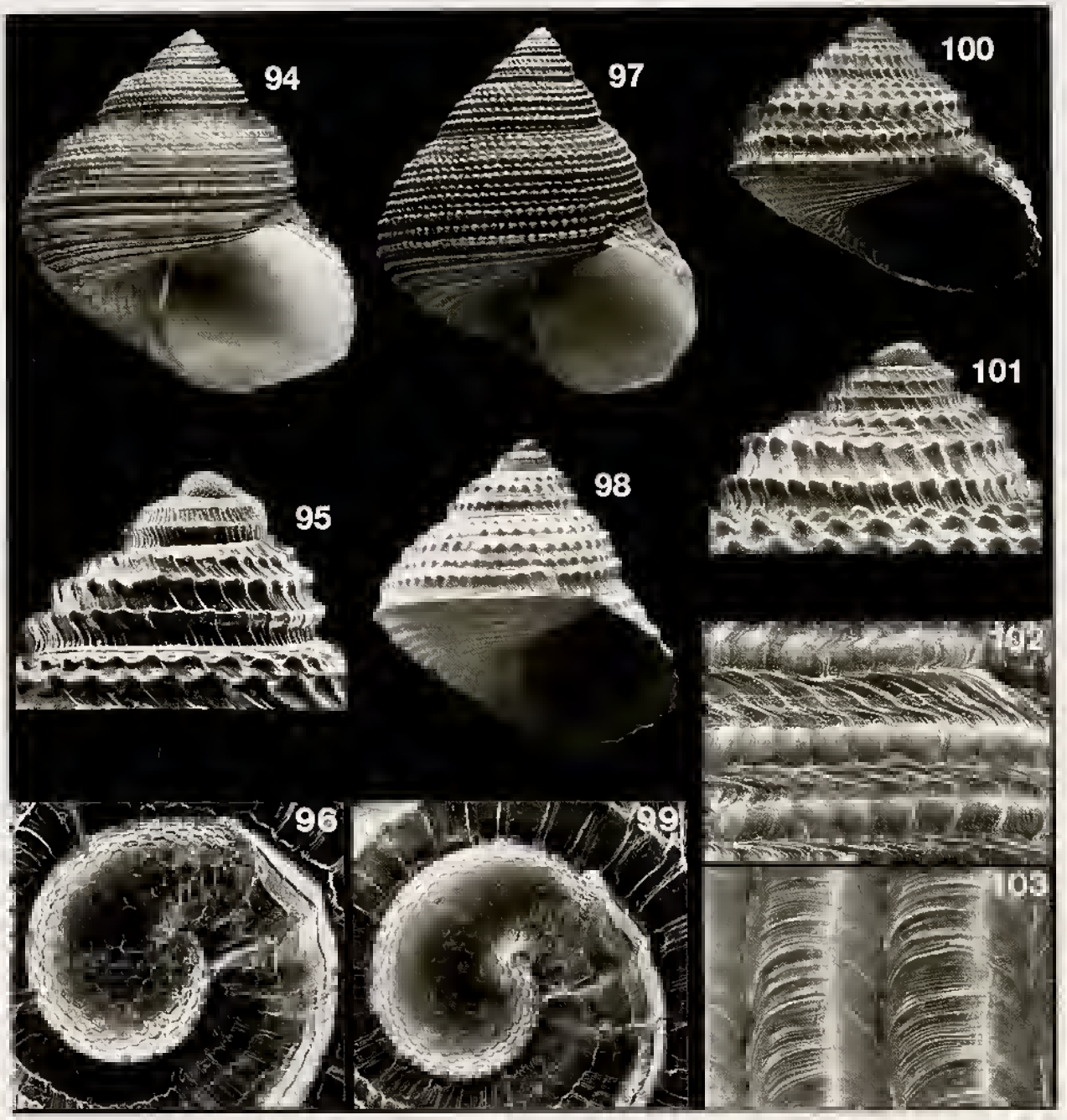
Radula (Figs 140-147). Radula ribbon very long, cross-row formula ∞ + 8-9 + 1 + 9-8 + ∞. Central tooth and inner 5 or 6 pairs of lateral teeth thin in section with concave faces, elliptical, tips tapered with irregular ragged edges. Outer 3 pairs of lateral teeth reduced. Marginal teeth similar in shells up to about 3.5 mm in width, slender, thin in section: tips blunt, broad, finely serrate. In larger specimens, inner 8 or 9 pairs of marginal teeth becoming much stouter than outer teeth, leading edge with strong terminal cusp and 4 or 5 smaller subterminal cusps, below them a prominent projection; innermost marginal smaller than adjacent marginals. Innermost marginals continuing to stouten into late ontogeny, terminal cusp becoming relatively much larger, and projection below cusps relatively stronger.

TABLE 19. — *Fautrix candida*. Shell measurements (mm) and countings.

H	D	H/D	TW	
06.40	06.45	0.99	4.40	CHALCAL 2: stn DW 76
11.70	10.50	1.11	5.00	SMIB 4: stn DW 61
14.00	13.10	1.07	5.00	Holotype

REMARKS. — *Fautrix candida* is extremely distinctive in its strongly convex whorls, narrow umbilicus, nacreous white shell, crowded axials on the first teleoconch whorl, external anatomy and radular morphology. As described above the adult holotype, a subadult paratype, and a smaller

Source : MNHN, Paris



FIGS 94-103. — Genera *Fautrix* and *Thysanodonta*. — **94**, *Fautrix candida*, holotype, 14.0 × 13.1 mm. — **95-96**, *F. candida*, paratype, CHALCAL 2: stn DW 76, 95 × 34, 96 × 126. — **97**, *F. aquilonia*, holotype, 14.0 × 12.6 mm. — **98**, *F. candida*, off Three Kings Islands, New Zealand, 310 m, NMNZ M61466, 4.20 × 4.40 mm. — **99-101**, *F. aquilonia*, paratype, MUSORSTOM 4: stn DW 156, 4.80 × 5.20 mm, 99 × 122, 101 × 29. — **102-103**, *Thysanodonta eucosmia*, holotype, details of sculpture on last teleoconch whorl (102, × 28) and on base (103, × 67).

specimen from northern New Zealand, exhibit very pronounced differences in inner marginal tooth morphology. All of the specimens examined appear to be indistinguishable in shell morphology, so it would seem that the radula differences in the three different-sized specimens examined represent stages in development within a single species.

ETYMOLOGY. — Latin *candidus* (white).

Source : MNHN, Paris

Fautrix aquilonia sp. nov.

Figs 97, 99-101, 157; Table 20

TYPE MATERIAL. — Holotype MNHN. Paratypes: 2 MNHN, 1 NMNZ M262480.

TYPE LOCALITY. — N. New Caledonia, MUSORSTOM 4, stn DW 197, 18°51′ S, 163°21′ E, 550 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 156, 18°54′ S, 163°19′ E, 525 m, 1 dd (paratype). — Stn DW 197, 18°51′ S, 163°21′ E, 550 m, 3 dd (holotype and paratypes: 1 MNHN, 1 NMNZ).

DISTRIBUTION (Fig. 157). — Grand Passage, northern New Caledonia, 525-550 m (dead).

DESCRIPTION. — Shell up to 14 mm high, glossy, rather thin, spire broadly conical, weakly cyrtoconoid, about 1.09 × as high as aperture at maturity, very narrowly umbilicate, translucent white.

Protoconch 400 µm wide, sculptured with dense network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip broadly rounded, terminal varix strong.

Teleoconch of up to 5.75 convex whorls; 1st eighth whorl sculptured with spiral lirae and strong, rounded varix, delineated by growth scar. Periphery rounded, base weakly convex, tightly rounded into umbilicus. Spiral cords prominent, multiplying by intercalation, stronger on spire than on base, nodules crowded, rounded, stronger on spire than on base, especially in juveniles. Axial riblets fine, crisp and crowded on 1st half whorl, progressively enlarging and becoming more widely spaced, weakening and becoming obsolete on 3rd whorl. P1-P4 commencing immediately after post larval scar, resolving from fine threads, rapidly enlarging, P2-P4 similar throughout; P1 weaker on 1st 3 whorls, thereafter as strong as P2-P4; P4 partly covered by succeeding whorls. Secondary spirals enlarging to resemble primaries, S1 commencing on mid 2nd - mid 3rd whorl, S2 at about mid 3rd whorl, S3 on mid - late 3rd whorl. Tertiary spirals enlarging to resemble primaries and secondaries, a spiral commencing between suture and P1 on early 2nd - mid 4th whorl, additional tertiaries intercalating on mid 4th - early 5th whorl, adult specimen (holotype) with total of 12 spiral cords on spire on penultimate whorl. Base with 9-11, rounded primary spiral cords in front of parietal area, others intercalating. Fine collabral growth lines throughout. Aperture subcircular. Outer lip thin at rim, thickened within. Inner lip thick. Parietal inductura thin.

Animal unknown.

TABLE 20. — *Fautrix aquilonia*. Shell measurements (mm) and countings.

H	D	H/D	TW	
04.80	05.20	0.92	3.70	MUSORSTOM 4: stn DW 156
06.25	06.00	1.04	4.10	MUSORSTOM 4: stn DW 197
07.45	07.90	0.94	4.60	MUSORSTOM 4 stn DW 197
14.00	12.60	1.11	5.75	Holotype

REMARKS. — *Fautrix aquilonia* differs from the southern New Caledonian species *F. candida* in having stronger, more strongly nodular spiral cords on the teleoconch, a thicker, heavier shell, and a tighter sculptural network on the protoconch.

ETYMOLOGY. — Latin *aquilonius* (northern).

Subfamily THYSANODONTINAE Marshall, 1988

REMARKS. — Members of Thysanodontinae are highly distinctive in having exceedingly slender, hair-like radular teeth tipped with backwardly inclined barbs (Figs 148-149). A distinctive feature of the shell not noted in the original diagnosis concerns the collabral growth lines, which are at first rather evenly prosocline on the spire and opisthocyrt on the base. With increasing shell size the growth lines on the spire become more or less orthocline on the spiral cords, and increasingly

Source : MNHN, Paris

strongly prosocline in the spiral interspaces (Fig. 102). The basal growth lines become sharply serrated, each serration coinciding with a sharply incised spiral groove on the summit or inner slope of or between each spiral cord; the growth lines between the serrations are opisthocyrt (Fig. 103). The profile of the apertural rim in adults (damaged in all material) is thus strongly stepped — prosocline on the spire and sharply scalloped on the base. The growth lines in Calliostomatini and Fautricini are either rather evenly prosocline on the spire and opisthocyrt on the base, or at most weakly undulant, and basal grooves are absent. The group is further characterized by the presence of a single prominent submedian carina (P3) on the first 1.5-2.5 whorls (Figs 105, 108, 111, 114), though some species of *Bathyfautor* gen. nov. are similarly sculptured.

Genus *Thysanodonta* Marshall, 1988

Thysanodonta Marshall, 1988: 217. Type species (OD): *Thysanodonta aucklandica* Marshall, 1988; Recent, New Zealand.

Thysanodonta boucheti Marshall, 1988

Fig. 158; Table 21

Thysanodonta boucheti Marshall, 1988: 219, figs 3G-I.

TYPE MATERIAL. — Holotype MNHN.

TYPE LOCALITY. — N. New Caledonia, LAGON, stn 444, Atoll de Surprise, 18°15′ S, 162°59′ E, 300-350 m.

MATERIAL EXAMINED. — **New Caledonia.** LAGON: stn 444, 18°15′ S, 162°59′ E, 300-350 m, 1 dd (holotype).
MUSORSTOM 4: stn DW 197, 18°51′ S, 163°21′ E, 550 m, 5 dd (MNHN, NMNZ M262477).
BIOCAL: stn DW 77, 22°15′ S, 167°15′ E, 440 m, 1 dd.

DISTRIBUTION (Fig. 158). — Northern and southern New Caledonia, 300-550 m (dead).

TABLE 21. — *Thysanodonta boucheti*. Shell measurements (mm) and countings (LAGON: stn 444, BIOCAL: stn DW 77, MUSORSTOM 4: stn DW 197).

Character	*n*	Range	Mean	SD
H	6	4.95-8.90	6.78	1.60
D	6	4.00-6.95	5.20	1.19
H/D	6	1.15-1.42	1.30	0.10
TW	6	5.25-6.75	6.05	0.54

REMARKS. — The only specimen known from southern New Caledonia (BIOCAL: stn DW 77) differs from the holotype and other northern specimens in being slightly more broadly conical, in being slightly larger relative to the number of whorls, and in having a stronger, more strongly nodular P4 (Table 21). In the absence of material from intermediate localities it is impossible to ascertain the status of this specimen, but it is tentatively interpreted as a regional variant of *T. boucheti*.

Source : MNHN, Paris

Thysanodonta festiva sp. nov.

Figs 104-106, 158

TYPE MATERIAL. — Holotype (6.60 × 4.60 mm, 6.90 TW) and 1 paratype dd (7.40 × 5.00 mm, 7.25 TW) MNHN.

TYPE LOCALITY. — S. New Caledonia, CHALCAL 2, stn DW 71, 24°42′ S, 168°10′ E, 230 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION (Fig. 158). — Northern Norfolk Ridge, 230 m, dead.

DESCRIPTION. — *Shell* up to 7.40 mm high, glossy, stout, spire narrowly and evenly conical, 1.83-2.11x as high as aperture, mean spire angle 42-44°, anomphalous.

Colour of apical fold tip and adapical extremity of protoconch brown, protoconch elsewhere white. First 1.5 teleoconch whorls translucent dull mauve. Next 1.5 whorls with irregularly broken brown bands on P1-P3 and S2, P4 white with brown spots between nodules. Subsequent whorls either with much paler, gradually fading pigmentation on P1-P3 and S2, and white on S3, the spiral below it with few scattered brown spots; or white with S3 and spiral below it pale brown. Base either uniform white or with few narrow pale brown axial bands.

Protoconch 370 µm wide, sculptured with dense network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip rounded, terminal varix strong.

Teleoconch of up to 7.25 whorls, 1st eighth whorl with crisp spiral threads, delineated by strong, rounded varix and growth scar. First whorl submedially angulated at P3, angulation weakening and vanishing on 2nd whorl, subsequent whorls flat, suture flush, periphery rounded, base weakly convex. Spiral cords prominent, spire spirals with rounded nodules; P3 and P4 commencing immediately after post larval scar. P3 strong throughout; P4 weak, becoming fully fused with S3. P1, P2, S2 and S3 resolving on 2nd whorl, P1, P2 and S2 rapidly enlarging to resemble P3; S3 larger than others on 2nd and 3rd whorl, bifurcating on 3rd whorl to form 2 nodular spirals similar to P3. Axial costae strong and widely spaced on 1st 2 whorls, weaker, closer and becoming obsolete on 3rd whorl. Base with 8 or 10 strong, rounded similar, smooth spiral cords, each sharply grooved on inner slope. First and early 2nd whorl with fine, crisp spiral threads. Collabral growth lines on spire prosocline on early whorls, with increasing shell size becoming more or less orthocline on spiral cords and increasingly strongly prosocline between spirals. Basal collabral growth lines sharply serrated, the serrations coinciding with grooves on inner slopes of each spiral, opisthocyrt between serrations. Aperture subquadrate. Outer lip thin at rim, thickened within. Inner lip thick. Parietal inductura thin.

Animal unknown.

REMARKS. — *Thysanodonta festiva* differs from *T. boucheti* in being coloured instead of uniform white, in being more narrowly conical, and in having finer nodules, and 6 instead of 4 spiral cords on the adult spire whorls.

Thysanodonta chesterfieldensis sp. nov.

Figs 107-109, 154

TYPE MATERIAL. — Holotype (3.60 × 2.85 mm, 5.00 TW) and 1 paratype MNHN.

TYPE LOCALITY. — Chesterfield Islands, MUSORSTOM 5, stn 345. 19°40′ S, 158°32′ E, 305-310 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn 345, 19°40′ S, 158°32′ E, 305-310 m, 1 dd (holotype). — Stn 362, 19°53′ S, 158°40′ E, 410 m, 1 dd (paratype).

DISTRIBUTION (Fig. 153). — Off Chesterfield Islands, 305-410 m (dead).

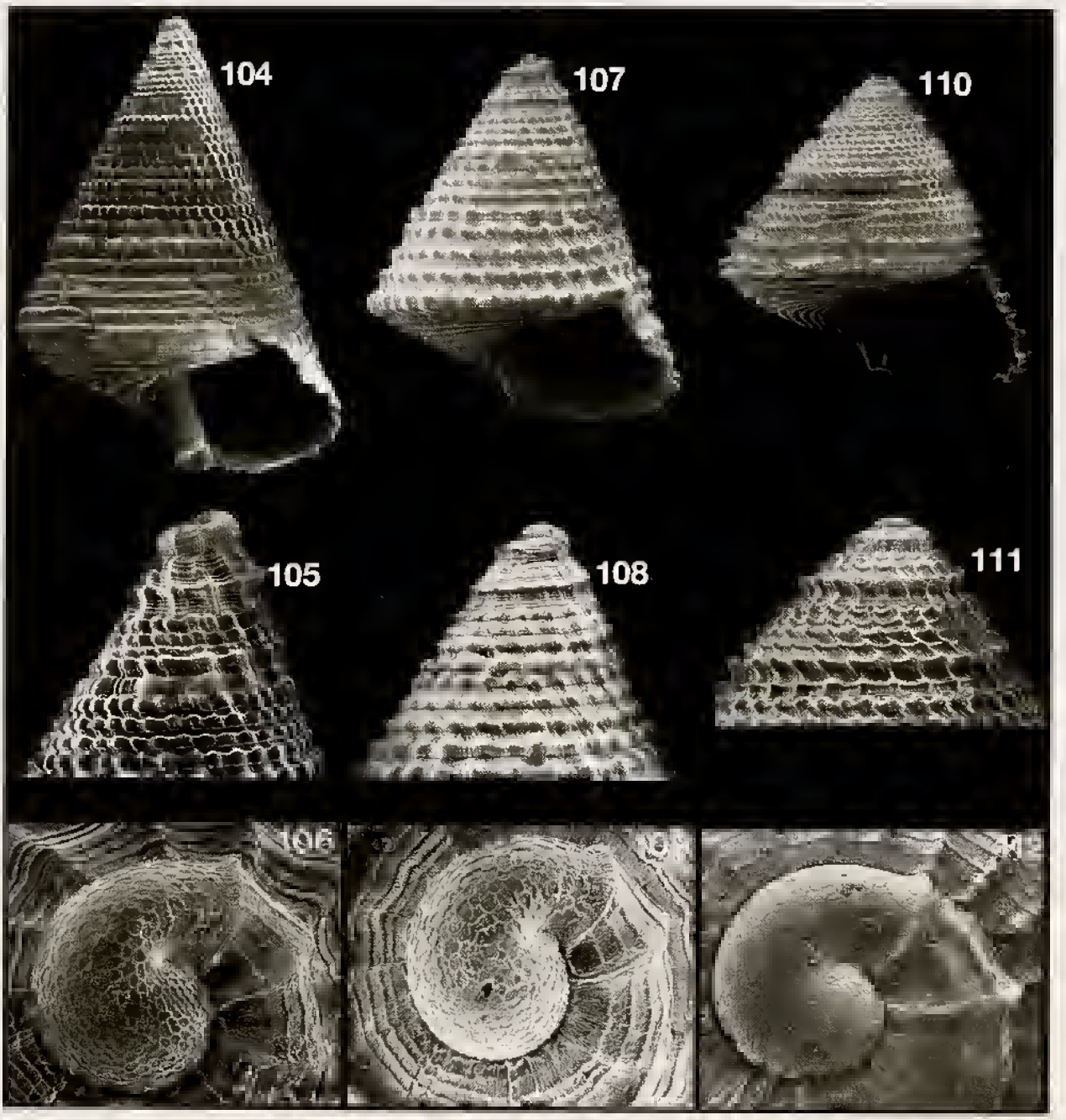
DESCRIPTION. — *Shell* (immature holotype) 3.60 mm high, glossy, stout, spire narrowly conical, 1.77x higher than aperture, mean spire angle 52°, anomphalous.

Colour of adapical half of protoconch pale brown, elsewhere white. Subsequent whorls translucent white; P4 with reddish brown spots, scattered reddish spots on other spire spirals. Base translucent white.

Protoconch 370 µm wide, sculptured with dense network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip rounded, terminal varix strong.

Teleoconch of 5.10 whorls; 1st eighth whorl with crisp spiral threads, delineated by strong, rounded varix and growth scar. First whorl submedially angulated at P3, angulation weakening and vanishing on 2nd whorl; subse-

Source : MNHN, Paris



FIGS 104-112. — Genus *Thysanodonta*. — **104-106**, *Thysanodonta festiva*, holotype, 6.60 × 4.60 mm, 105 × 28, 106 × 126. — **107-109**, *T. chesterfieldensis*, holotype, 3.60 × 2.85 mm, 108 × 26, 109 × 126. — **110-111**, *T. opima*, holotype, 9.10 × 8.80 mm, 111 × 18. — **112**, *T. opima*, paratype, BIOCAL: stn DW 70, × 112.

quent whorls flat, suture flush, periphery angulated at P4, base weakly convex. Spiral cords prominent, rounded, P1-P4 with rounded nodules, basal spirals weaker, almost smooth; axial costae gradually resolving on 1st whorl, strong on 2nd whorl, weakening until obsolete on 3rd whorl. P3 and P4 commencing immediately after post larval scar; P3 strong throughout; P1 and P2 resolving early on 2nd whorl, rapidly enlarging to resemble P3; P4 either resembling P1-3 (paratype) or with weak median groove from mid 2nd whorl (holotype). Base with 8 similar, rounded spiral cords. First whorl with crisp spiral threads, becoming obsolete on 1st half of 2nd whorl. Fine collabral growth lines throughout, prosocline on spire, opisthocyrt on base. Aperture subquadrate. Outer lip thin at rim, thickened within. Inner lip thick. No parietal inductura.

Animal unknown.

Source : MNHN, Paris

REMARKS. — *Thysanodonta chesterfieldensis* resembles *T. festiva* in having a colour pattern, yet differs from that species and resembles *T. boucheti* in having only 4 spiral cords on the spire whorls. It differs further from *T. boucheti* in having a more open network of hexagons on the protoconch, and in having axial sculpture on the early teleoconch that is less crisply defined.

Thysanodonta opima sp. nov.

Figs 110-112, 158

TYPE MATERIAL. — Holotype (9.10 × 8.80 mm, 5.75 TW) and 1 paratype (4.20 × 4.40 mm, 3.80 TW) MNHN.

TYPE LOCALITY. — S. New Caledonia, BIOCAL, stn DW 48, 23°00′ S, 167°29′ E, S, 775 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 48, 23°00′ S, 167°29′ E, 775 m, 1dd (holotype). — Stn DW 70, 23°25′ S, 167°53′ E, 965 m, 1 dd (paratype).

DISTRIBUTION (Fig. 158). — South of Ile des Pins, southern New Caledonia, 775-965 m, dead.

DESCRIPTION. — *Shell* up to 9.10 mm high, glossy, stout, spire broadly conical. 1.36× as high as aperture (adult); mean spire angle (adult) 62°, narrowly umbilicate, white.

Protoconch 350-370 μm wide, surface worn, apical fold tip rounded, terminal varix strong.

Teleoconch of up to 5.75 whorls; 1st eighth whorl with crisp spiral threads, delineated by strong, rounded varix and growth scar. First whorl submedially angulated at P3, angulation weakening on 2nd whorl, subsequent whorls weakly convex, suture almost flush; periphery angulated at P4, becoming tightly rounded on last adult whorl, base weakly convex. Spiral cords prominent, rounded, spire spirals with rounded nodules, basal spirals very weakly nodular at maturity; axial costae gradually resolving on 1st whorl, strong on 2nd and 3rd whorls, weakening on 4th whorl, obsolete thereafter. P3 and P4 commencing immediately after post larval scar, P3 strong throughout; P4 weakest, entirely covered by succeeding whorls. P1 and P2 resolving on 2nd whorl, S1 and S2 late 2nd · early 3rd whorl, S3 late 2nd · start 3rd whorl, all gradually enlarging to resemble P3. Adult base with 11 strong, similar, rounded, medially grooved spiral cords. Shoulder on 1st 1.5 whorls with numerous fine, crisp spiral threads. Collabral growth lines on spire prosocline on early whorls, with increasing shell size becoming more or less vertical on spiral cords and increasingly strongly prosocline between spirals. Basal collabral growth lines sharply serrated, the serrations coinciding with grooves at summits of each spiral, opisthocyrt between serrations. Umbilical rim tightly rounded. Aperture subquadrate. Outer lip rim broken away, thickened. Inner lip of moderate thickness, overhanging umbilicus. Parietal inductura thin.

Animal unknown.

REMARKS. — *Thysanodonta opima* is distinctive among *Thysanodonta* species in having a uniform white shell, a broadly conical spire, and an umbilicus.

ETYMOLOGY. — Well-fed (Latin).

Thysanodonta eucosmia sp. nov.

Figs 113-115, 148-149, 158

TYPE MATERIAL. — Holotype (12.0 × 9.00 mm, 7.00 TW) MNHN. Paratypes: 47 MNHN, 1 AMS C201710, 1 BMNH 1995.017, 1 NMP, 1 NMNZ M262478, 1 USNM.

TYPE LOCALITY. — S. New Caledonia, BIOCAL, stn DW 33, 23°10′ S, 167°10′ E, 675-680 m.

MATERIAL EXAMINED. — All type material. **New Caledonia**. BIOCAL: stn DW 33, 23°10′ S, 167°10′ E, 675-680 m, 10 dd (holotype and paratypes: 5 MNHN, 1 AMS, 1 BMNH, 1 NMP, 1 USNM). — Stn DW 36, 23°09′ S, 167°11′ E, 650-680 m, 3 dd (paratypes). — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 13 dd (paratypes). — Stn DW 48, 23°00′ S, 167°29′ E, 775 m, 4 dd (paratypes). — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 5 lv (paratypes: 4 MNHN, 1 NMNZ). — Stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 2 dd (paratypes).

Source : MNHN, Paris

FIGS 113-115. — Genus *Thysanodonta*. *Thysanodonta eucosmia*, holotype, 12.0 × 9.00 mm, 115 × 135.

Source : MNHN, Paris

MUSORSTOM 4: stn DW 220, 22°58′ S, 167°38′ E, 505-550 m, 2 dd (paratypes). — Stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 1 dd (paratype). — Stn DW 223, 22°57′ S, 167°30′ E, 545-560 m, 1 dd (paratype).

CHALCAL 2: stn DW 76, 23°41′ S, 167°45′ E, 470 m, 5 lv (paratypes). — Stn DW 77, 23°38′ S, 167°43′ E, 435 m, 2 dd (paratypes).

SMIB 3: stn DW 1, 24°56′ S, 168°22′ E, 520 m, 2 dd (paratypes). — Stn DW 22, 23°03′ S, 167°19′ E, 503 m, 1 dd (paratype). — Stn DW 24, 22°59′ S, 167°21′ E, 503 m, 2 dd (paratypes).

DISTRIBUTION (Fig. 158). — Northern Norfolk Ridge, 410-775 m, living at 470-700 m.

DESCRIPTION. — *Shell* up to 12.0 mm, glossy, rather thin but strong: spire conical, 1.37-2.42x as high as aperture; mean spire angle 40-60°, anomphalous, translucent white.

Protoconch 350-400 µm wide, sculptured with dense network of fine, crisp threads that enclose roughly hexagonal spaces, apical fold tip rounded, terminal varix strong.

Teleoconch of up to 7.00 whorls: 1st eighth whorl with crisp spiral threads, delineated by strong, rounded varix and growth scar. First 1.5 whorls sharply submedially angulated at P3, angulation weakening on next half whorl, subsequent whorls weakly convex or flat; periphery angulated at P4, becoming rounded at maturity; base weakly convex. Spiral cords prominent, rounded; axial costae fine on 1st whorl, gradually enlarging, strong on 2nd and 3rd whorl, becoming obsolete on 4th whorl. P3 and P4 commencing immediately after post larval scar; P3 very prominent, flange-like and adapically upturned on 1st 1.5 whorls, becoming less prominent on next half whorl, though remaining strong throughout: P4 partly covered by succeeding whorls; P1 and P2 commencing at about end of 2nd whorl, rapidly enlarging to resemble P3 and P4. S1 and S2 and frequently an extra spiral commencing more or less simultaneously with P1 and P2, resembling them throughout; S3 commencing on about mid 2nd whorl, rapidly enlarging to resemble others. Additional spirals intercalate on or after 4th whorl so that there are 9-11 similar spiral cords on adult penultimate whorl. Nodules rounded on spire, much finer on base. Base with 9-13 strong, rounded, similar spiral cords, separated by sharply incised grooves, each spiral cord divided into 2 sectors by sharply defined step. Minute granules throughout. Collabral growth lines on spire prosocline on early whorls, with increasing shell size becoming more or less vertical on spiral cords and increasingly strongly prosocline between spirals. Basal collabral growth lines sharply serrated, the serrations coinciding with grooves between each spiral cord, opisthocyrt between serrations. First 1.5-2 whorls with numerous fine, crisp spiral threads. Aperture subcircular. Outer lip thin at rim, weakly thickened within, rarely thick. Inner lip moderately thickened. Parietal inductura very thin, translucent.

Animal unknown (dried).

Radula (Figs 148-149) 6.50 mm long and 167 µm wide, teeth typical of the subfamily.

TABLE 22. — *Thysanodonta eucosmia*. Shell measurements (mm) and countings (BIOCAL: stns DW 33, DW 48, DW 51, DW66, MUSORSTOM 4: stns DW 220, DW 222, DW 223, CHALCAL 2: stns DW 76, DW 77).

Character	*n*	Range	Mean	SD
H	15	5.35-12.00	7.91	1.94
D	15	4.35-09.00	6.28	1.44
H/D	15	1.16-01.47	1.26	0.09
TW	15	5.25-07.00	6.02	0.54

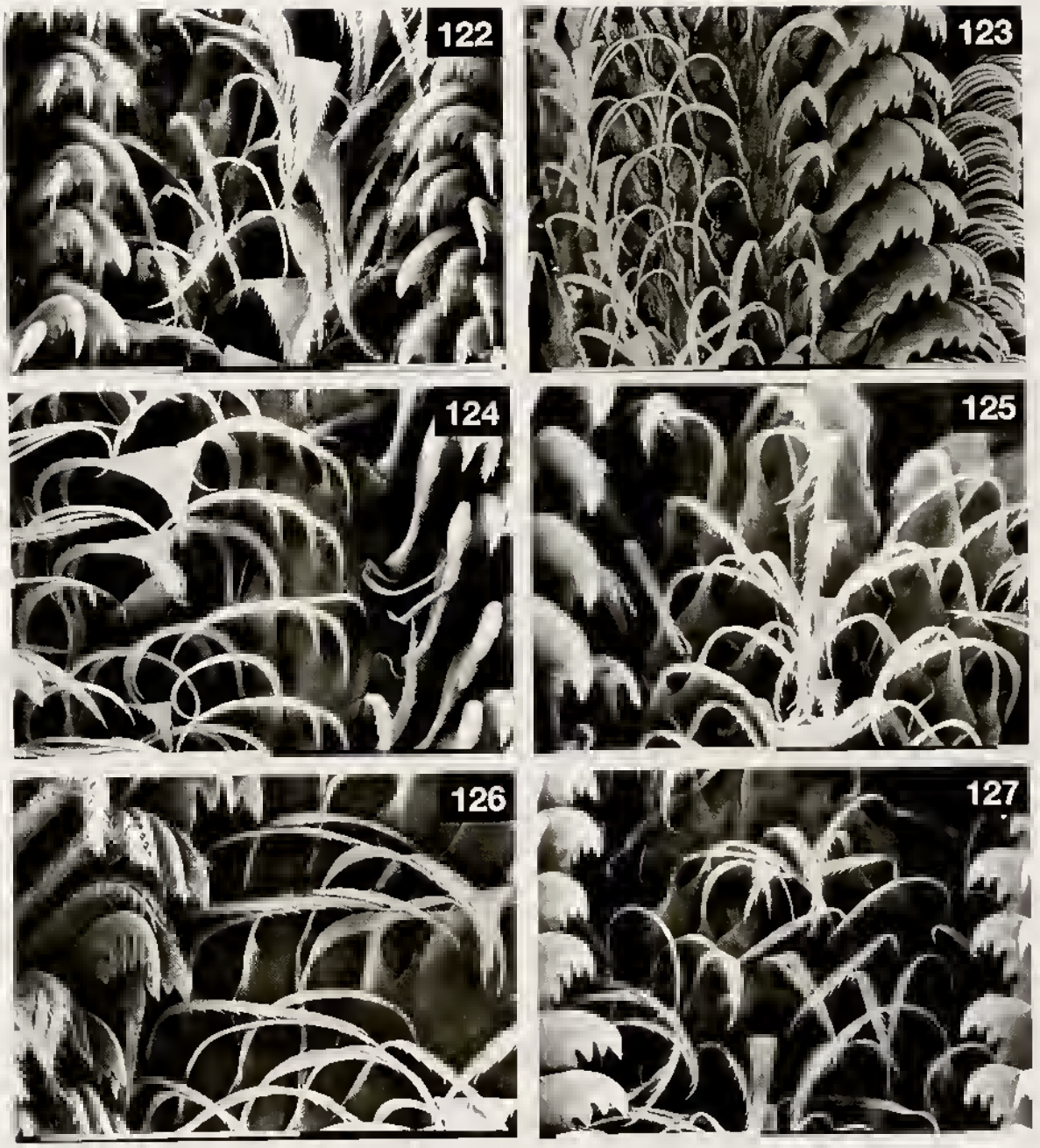
REMARKS. — *Thysanodonta eucosmia* is characterised by its numerous, narrow, finely nodular spire spirals, and in being covered with minute granules. Unlike other known *Thysanodonta* species, the basal grooves are situated on the inner sides of the spiral cords, rather than on their summits or inner slopes.

ETYMOLOGY. — Beautiful ornament (Greek).

Source : MNHN, Paris

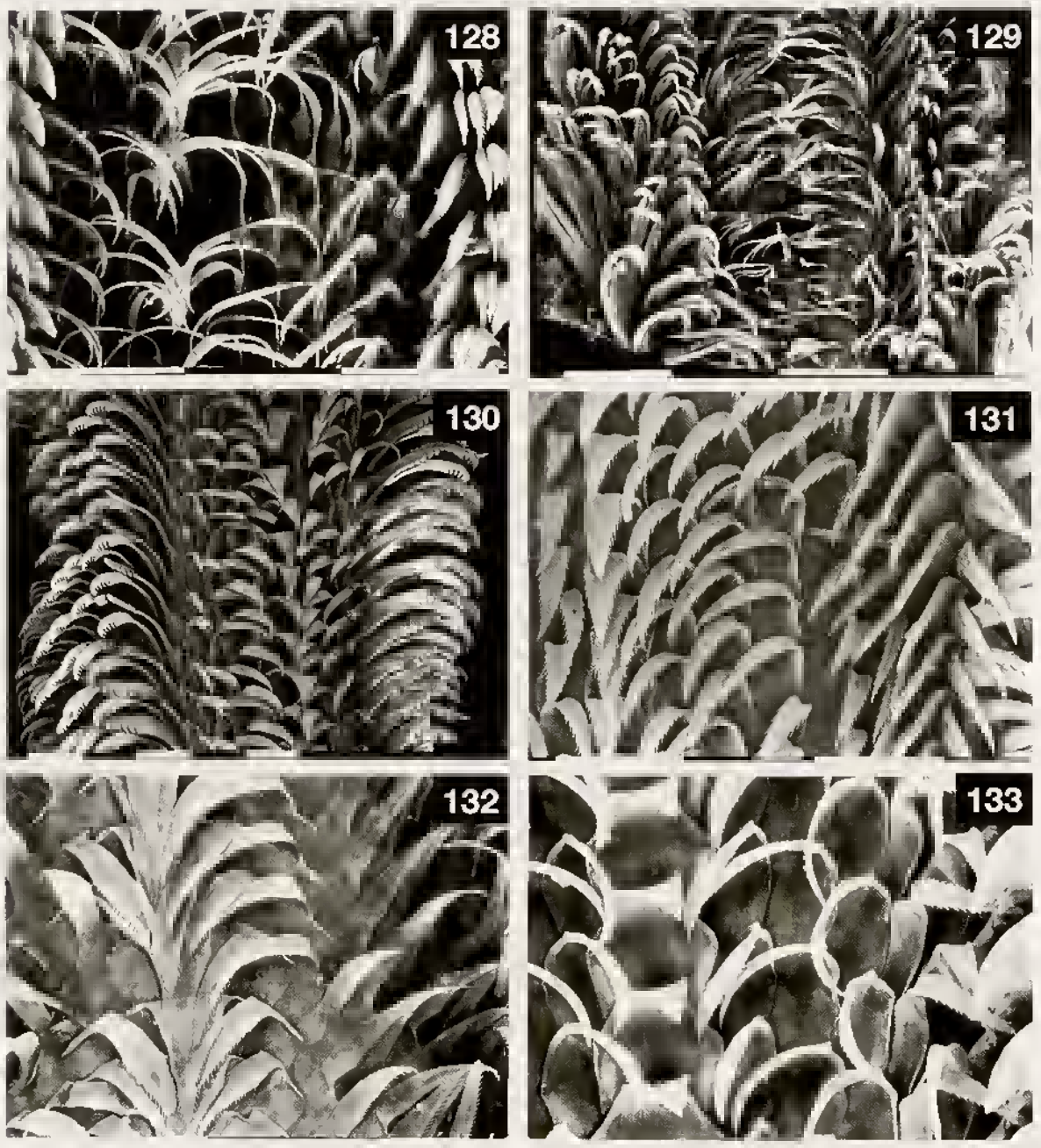
FIGS 116-121. — Central fields of adult radulae. — **116**, *Calliostoma (Fautor) comptum*, off Sydney, New South Wales, AMS C161945. — **117**, *C. (F.) boucheti*, *ex* paratype, CHALCAL 2: stn DW 74. — **118**, *C. (F.) richeri*, *ex* paratype, LAGON: stn 352. — **119**, *C. (F.) paradigmatum*, *ex* holotype. — **120**, *C. (F.) metivieri*, *ex* holotype. — **121**, *C. (F.) necopinatum*, *ex* paratype, LAGON: stn 444. Scale bars = 100 µm.

Source : MNHN, Paris



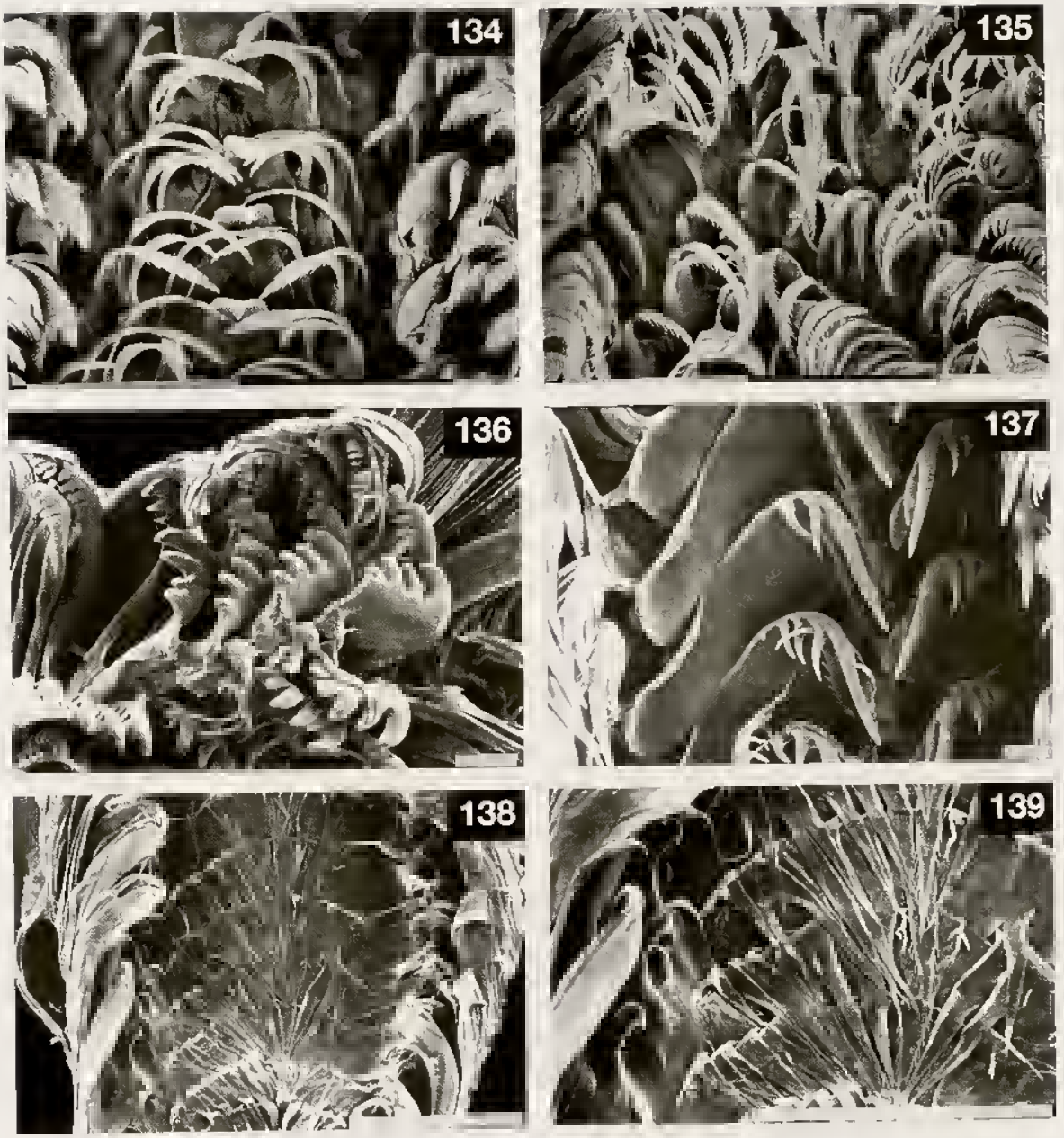
FIGS 122-127. — Central fields of adult radulae. — **122**, *Calliostoma (Fautor) houbricki*, *ex* holotype. — **123**, *C. (F.) periglyptum*, *ex* paratype, CHALCAL 2: stn DW 71. — **124**, *C. (F.) chesterfieldense*, *ex* holotype. — **125**, *C. (Benthastelena) katherina*, off Little Bay, Sydney, 183-192 m, AMS C152389. — **126**, *C. (B.) diadematum*, *ex* holotype. — **127**, *C. (B.) cristatum*, *ex* paratype, MUSORSTOM 4: stn DW 234. Scale bars = 100 µm.

Source : MNHN, Paris



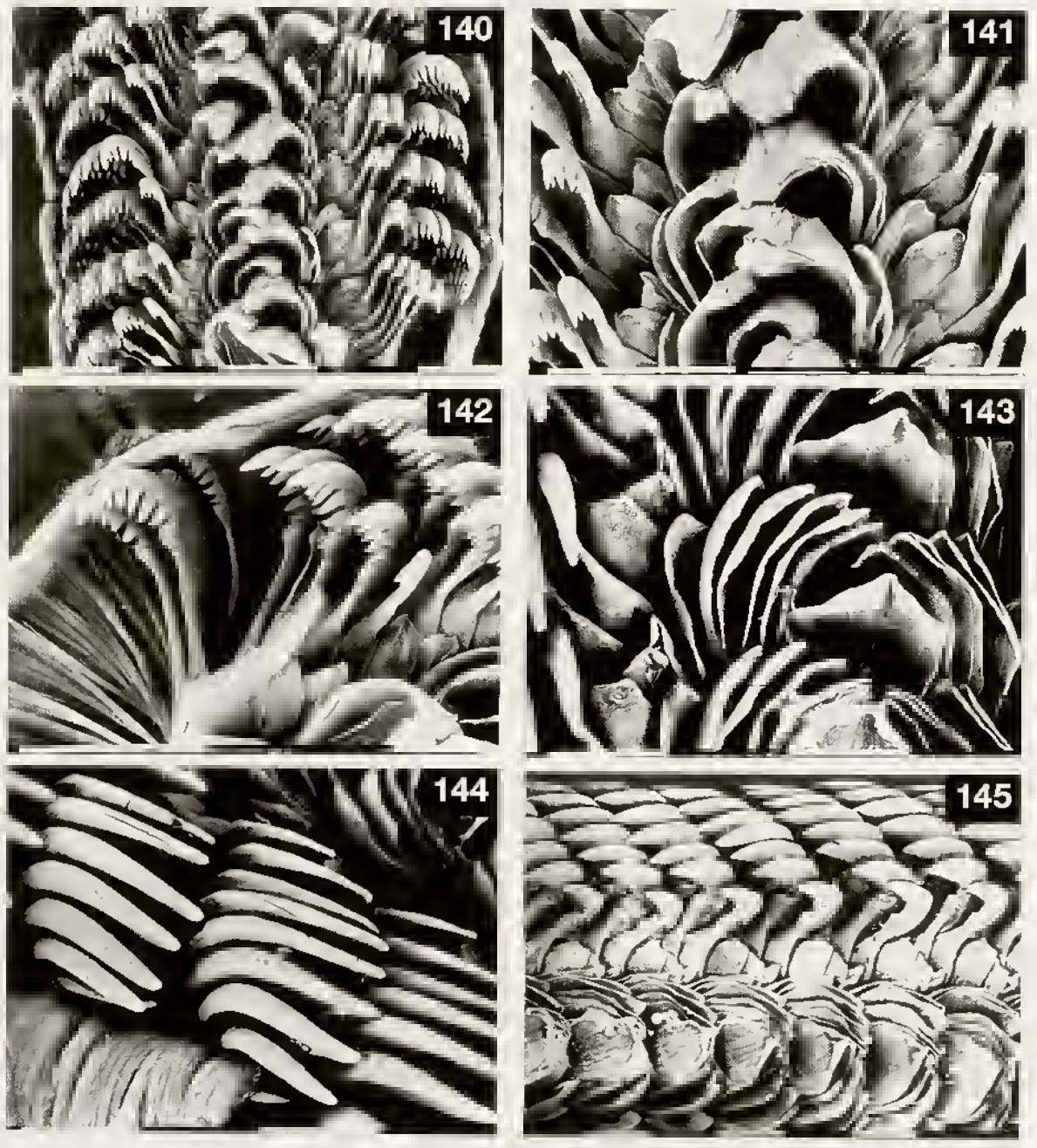
FIGS 128-133. — Adult radulae, full widths (129, 130) and central fields. — **128**, *Calliostoma (Benthastelena) coronatum*, *ex* paratype, LAGON: stn 394. — **129**, *C. (Anipullotrochus) xanthos*, MUSORSTOM 6: stn DW 459. — **130**, *C. (A.) peregrinum*, *ex* holotype. — **131**, *C. (A.) heros*, *ex* holotype. — **132**, *C. (A.) alisi*, *ex* holotype. — **133**, *Bathyfautor rapuhia*, *ex* holotype. Scale bars = 100 μm.

Source : MNHN, Paris



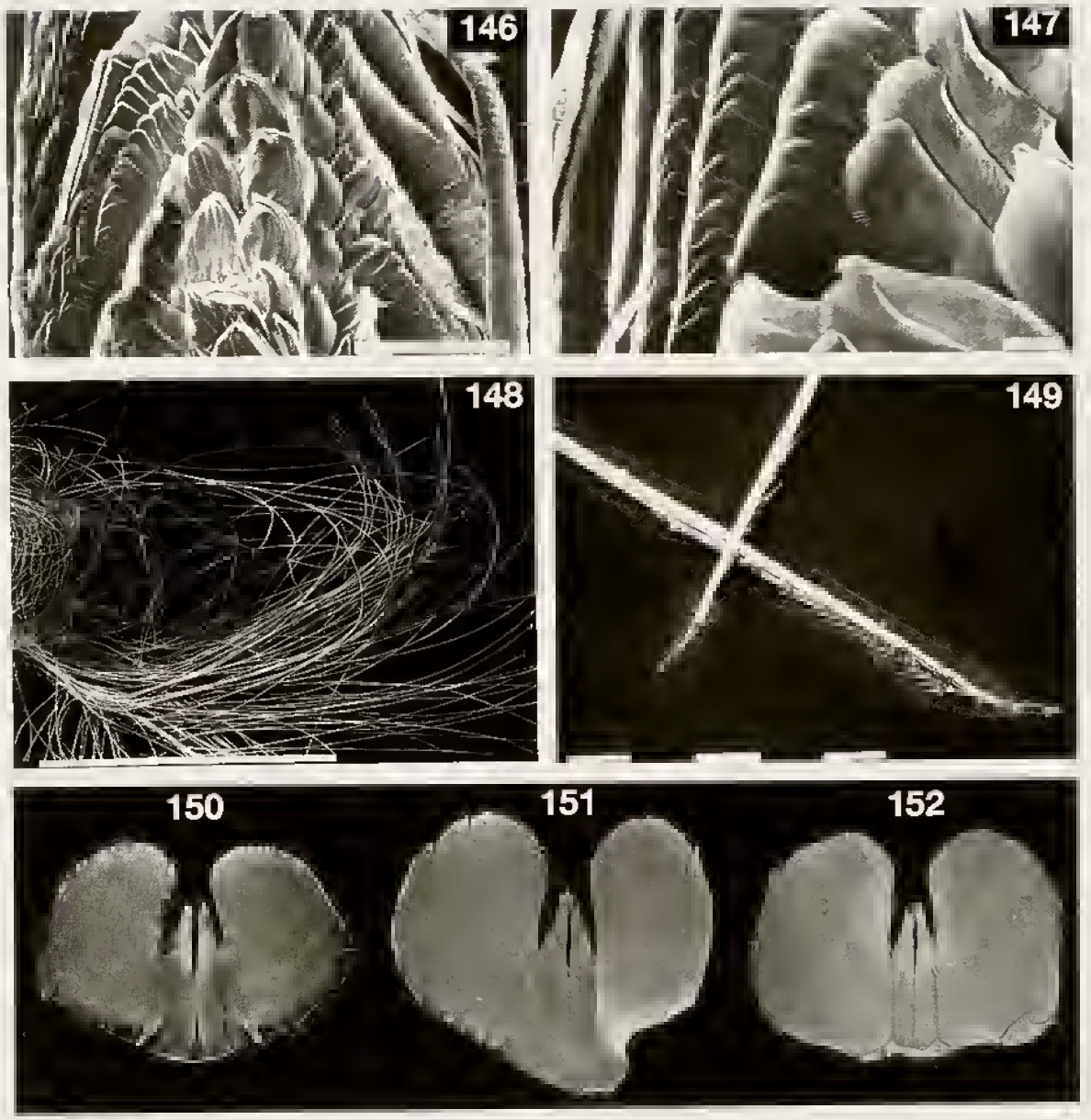
FIGS 134-139. — Radulae, central fields. – **134**, *Bathyfautor caledonicus*, *ex* adult paratype, MUSORSTOM 4: stn DW 160. — **135**, *Dactylastele poupineli* adult, off Barren Island, Queensland, 8 m, AMS C154352. — **136**, *Laetifautor trepidus*, *ex* adult paratype, off Mast Head Reef, Queensland, 31-36 m, AMS C102804. — **137**, *Laetifautor spinulosus*, adult, off Cape Donnington, South Australia, 18 m, NMNZ M237113. — **138-139**, *Selastele onustum*, off Three Kings Islands, northern New Zealand, 102 m, shell height 3.65 mm, NMNZ M34251. Scale bars 136, 137 = 10 µm, others = 100 µm.

Source : MNHN, Paris



FIGS 140-145. — Radulae, *Fautrix candida*. — **141-142**, *ex* paratype, shell height 6.40 mm, CHALCAL 2: stn DW 76; note sharp transition between inner marginals and blunt — tipped, finely serrate outer marginals in figure 142. — **143-145**, *ex* holotype, shell height 14.0 mm; note sharp transition between inner and outer marginals (Fig. 144), and enlarged terminal cusp on inner marginals (Fig. 145). Scale bars = 100 μm.

Source : MNHN, Paris



FIGS 146-152. — Radulae and jaws. — **146-147**, *Fautrix candida*, radula *ex* shell 3.30 × 3.40 mm, off Three Kings Islands, northern New Zealand, 221-206 m, NMNZ M80659; note smooth morphological gradation through lateral and marginal teeth. — **148-149**, *Thysanodonta eucosmia*, radula *ex* adult paratype, CHALCAL 2: stn DW 76. — **150**, *Calliostoma (Fautor) boucheti*, jaws *ex* paratype, CHALCAL 2: stn DW 74, × 35. — **151**, *C. (F.) vaubani*, jaws *ex* paratype, MUSORSTOM 4: stn DW 181, × 63. — **152**, *C. (Benthastelena) katherina*, off Little Bay, Sydney, 183-192 mm, AMS C152389, × 53. Scale bars 146 = 100 µm, 147 = 10 µm, 148 = 1 mm, 149 = 10 µm.

Source : MNHN, Paris

BIOGEOGRAPHY

Most of the few calliostomatid species reared in aquaria laid gelatinous egg masses, passed through a brief intracapsular veliger larval stage, and hatched as crawling young (ROBERT, 1902; LEBOUR, 1936; RAMON, 1990). *Calliostoma ligatum* (Gould, 1849) is known to be a broadcast spawner and to have a brief planktonic larval stage (HOLYOAK, 1988), which, together with the existence of a few species at exceptionally remote localities, indicates that at least some calliostomatids have more than minimal potential for dispersal by ocean currents. From a general standpoint, however, the majority of species evidently have rather limited potential for long distance dispersal in the plankton.

In the tropical and subtropical western Pacific, the only calliostomatids known to occur at localities separated by depths too great for the species and distances greater than 500 km are *Calliostoma (Benthastelena) tosaense*, *C. (Ampullotrochus) xanthos*, *C. (A.) peregrinum*, and *Dactylastele poupineli*. These species evidently owe their distributions to a drifting larval period of exceptional duration for the family. The other widely though patchily distributed species, *Laetifautor rubropunctatus* and perhaps *Coralastele punctocostatum* (if *C. allanae* is a synonym), may eventually prove to have a more or less continuous distributions between Japan and Queensland via the Nansei Chain, the Philippines, and New Guinea. Of these six widely distributed species, three are intimately associated with coral reefs (*D. poupineli*, *L. rubropunctatus*, and *C. punctocostatum*).

The family is very poorly represented in the central Pacific. The only coral reef-associated calliostomatids known from the western-central Pacific east of longitude 150° E in the northern hemisphere and longitude 170° E in the southern hemisphere are respectively two apparently undescribed species from Kwajalein, Marshall Islands (JOHNSON 1990, 1991 — specimens NMNZ) and *Dactylastele poupineli* from Fiji (NMNZ). The only other calliostomatids known from the tropical and subtropical Pacific east of Melanesia and west of central America are *Calliostoma margaritissimum* Habe & Okutani, 1968 (of Midway Island, *ca.* 480 m), *C. imperialis* Kosuge, 1979 (NE off Midway Island, ca. 1000 m), and *C. dorconni* Kay, 1979 (off Hawaii, 250-280 m) — incidentally *Omphalotukaia midwayensis* Lan, 1990 is a species of *Calliotropis* Seguenza, 1903 (Trochidae, Eucyclinae). All of these species are known only from the localities mentioned.

My own (unpublished) studies of the Australian Recent and rich Tertiary calliostomatid fauna reveal that it is comprised almost entirely of archaic groups — mainly Fautricini and the *Astele* group — and that there is little evidence of inward or outward range expansions of respectively derived or old groups.

Of the distributional patterns revealed during the present study, one of the most striking is that of *Calliostoma (Benthastelena) katherina*, *C. (B.) diadematum*, *C. (B.) cristatum*, and *C. (B.) coronatum*, which occupy roughly parallel distributional arcs (Figs 154, 156). *C. (B.) katherina* (off Queensland coast) and *C. (B.) diadematum* may have originated from parent stock isolated by the opening of the Tasman Sea (Late Cretaceous — Late Paleocene) (KAMP, 1986). The absence from the Lord Howe Seamount Chain of characteristically Australian groups, such as the phylogenetically primitive *Astele* group, may indicate that depths in the northern Tasman Sea during early stages of its formation were too great for them but favourable for *Benthastelena* species, which currently range deeper than any other calliostomatids known from off Queensland (*C. (B.) katherina* to 281 m). The New Caledonian species *C. (B.) cristatum* and *C. (B.) coronatum* may in turn have originated from separate colonisations by early *C. (B.) diadematum* stock. A fifth component of the group, either a form of *C. (B.) diadematum* or a closely related species, is represented by single shells from the Chesterfield Reefs at the northern end of the Lord Howe Seamount Chain and off southern New Caledonia (Figs 154, 156).

New Caledonian species here referred to *C. (Ampullotrochus)* evidently have closest affinities with western Atlantic species, which suggests a Tethyan origin. So too perhaps does the presence of

Source : MNHN, Paris

C. (Fautor) species, if indeed the eastern Atlantic species *C. lithocolletum* Dautzenberg is consubgeneric.

Assuming that Calliostomatinae originated from Fautricini or its stem group, it is remarkable that none of the ancestral stock can be recognised among known Recent and Tertiary calliostomatids from anywhere else in the world beyond Australia, the New Caledonia area and northernmost New Zealand. The stem group was either much more widely distributed and is now long extinct (or unrecognised) elsewhere, or subfamily Calliostomatinae spread outwards from a southern (Gondwana) centre of origin. The latter option is favoured here. The distribution of subfamily Thysanodontinae, currently known only from southern Africa, Australia, New Caledonia and New Zealand also suggests a Gondwanian origin. It would not be surprising, therefore, if Fautricini and perhaps relatives of the *Astele* group were recognised off southern Africa, southern South America or Antarctica.

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Source : MNHN, Paris

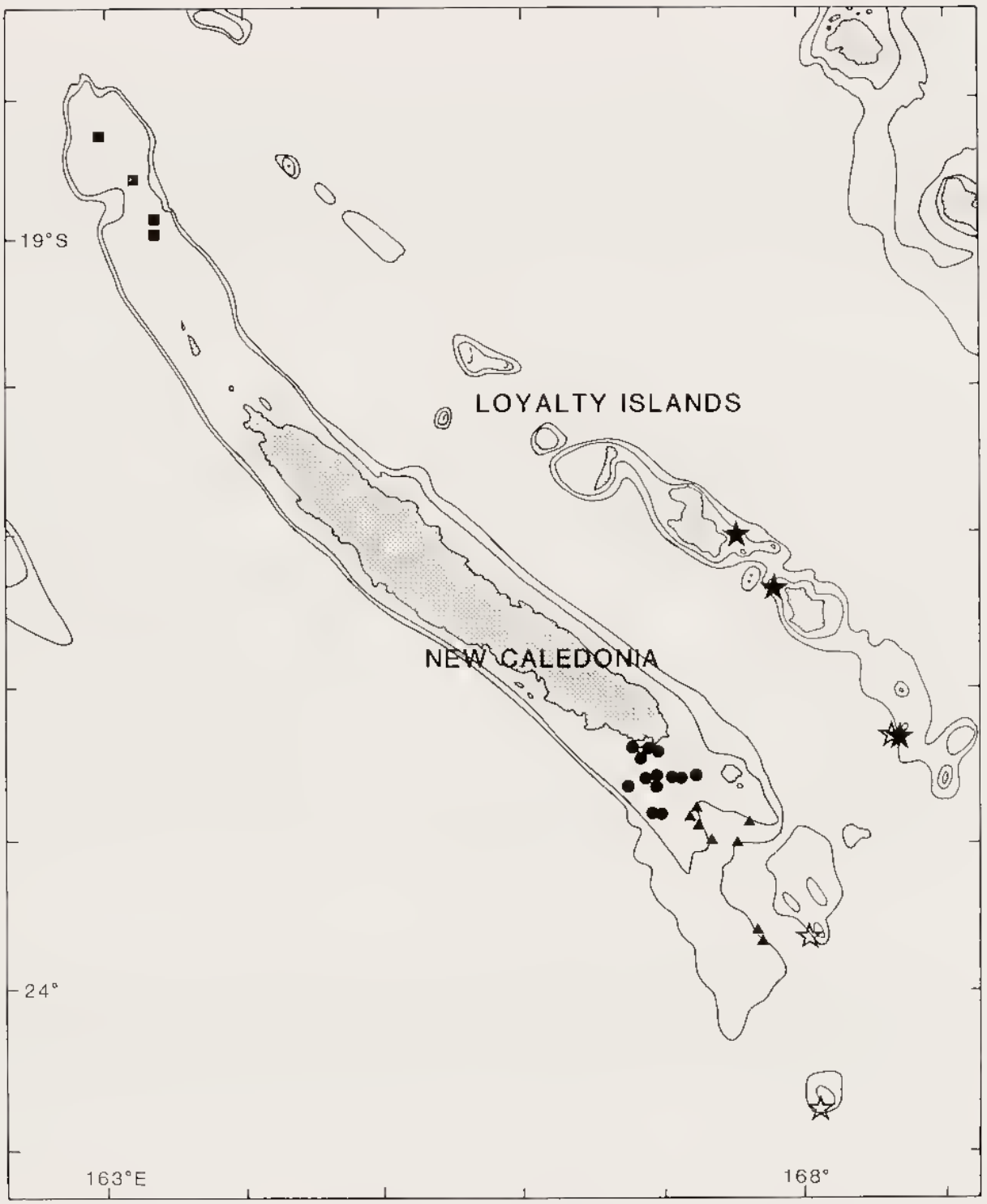

FIG. 153. Distribution of *Calliostoma (Fautor) richeri* (●), *C. (F.) vaubani* (■), *C. (F.) metivieri* (▲), *C. (Ampullotrochus) peregrinum* (☆) and *C. (A.) heros* (★).

Source : MNHN, Paris

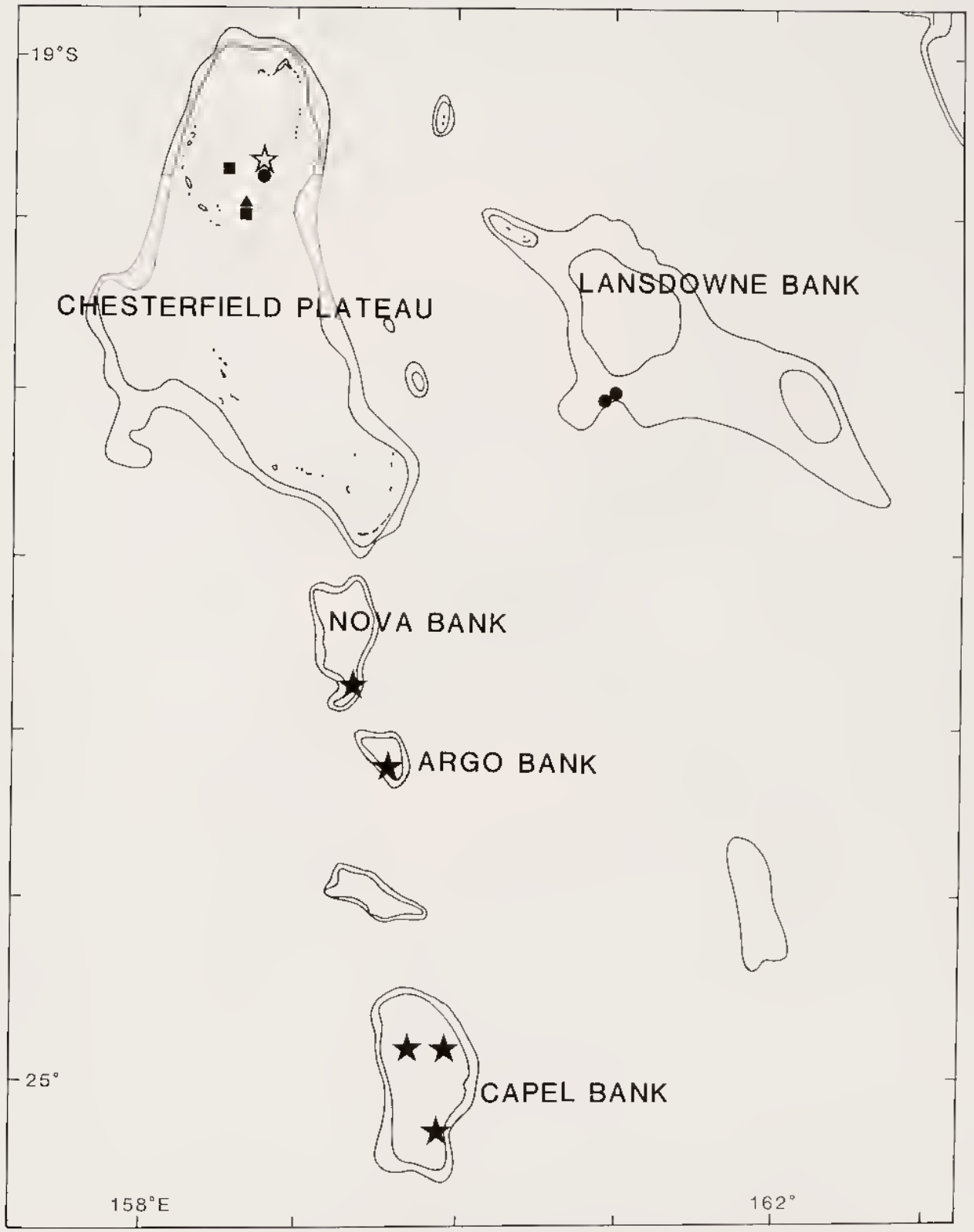

FIG. 154. - Distribution of *Calliostoma (Fautor) chesterfieldense* and *C. (Benthastelena) tosaense* (▲), *C. (B.) diadematum* (★), *C. (B.)* sp. cf. *diadematum* (☆), *Bathyfautor coriolis* (●), and *Thysanodonta chesterfieldensis* (■).

Source : MNHN, Paris

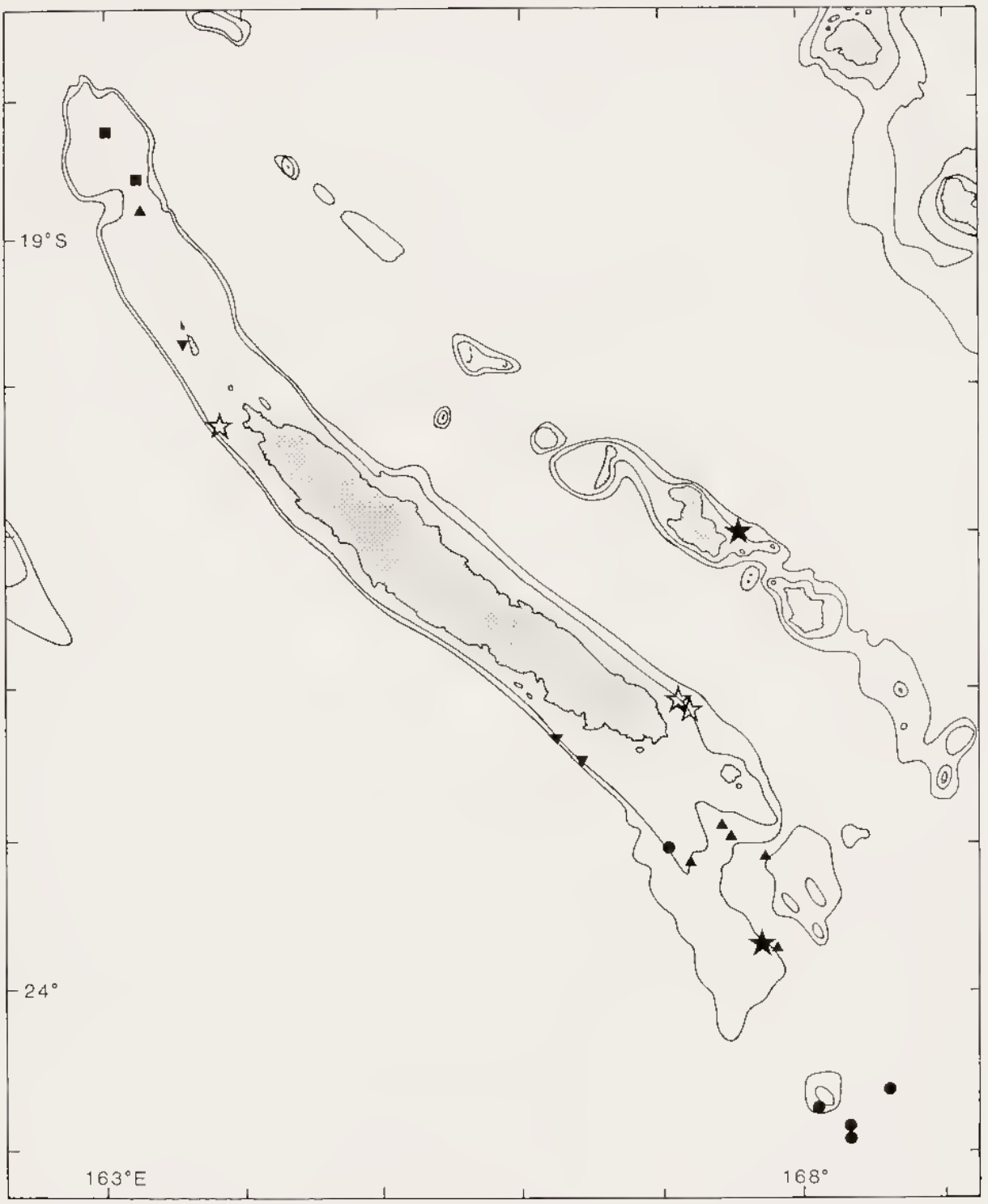

FIG. 155. Distribution of *Calliostoma (Fautor) boucheti* (●), *C. (F.) necopinatum* (■), *C. (F.) paradigmatum* (▲), *C. (Benthastelena) pertinax* (☆), *C. (Ampullotrochus) xanthos* (☆), and *Dacrylastele poupineli* (▼).

Source : MNHN, Paris

FIG. 156. — Distribution of *Calliostoma (Fautor) houbricki* (■), *C. (F.)* sp. cf. *metivieri* (★), *C. (Benthastelena) coronatum* (●), *C. (B.) cristatum* (▲), *C. (B.) tosaense* (▼), and *C. (B.)* sp. cf. *diadematum* (☆).

Source : MNHN, Paris

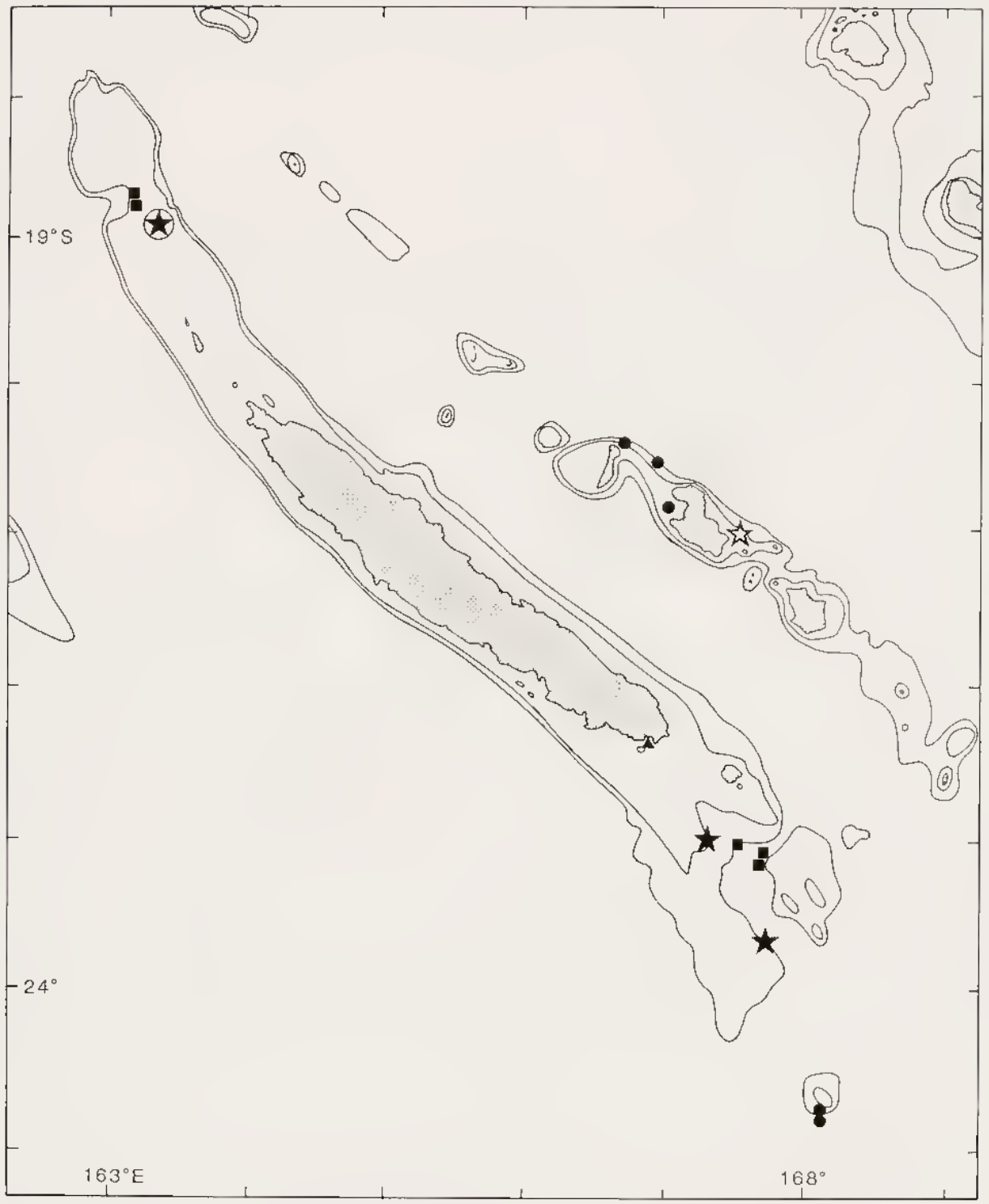

FIG. 157. — Distribution of *Calliostoma (Fautor) periglyptum* (●), *C. (Ampullotrochus) alisi* (☆), *Bathyfautor caledonicus* (■), *Laetifautor fundatus* (▲), *Fautrix aquilonia* (⊛), and *F. candida* (★).

Source : MNHN, Paris

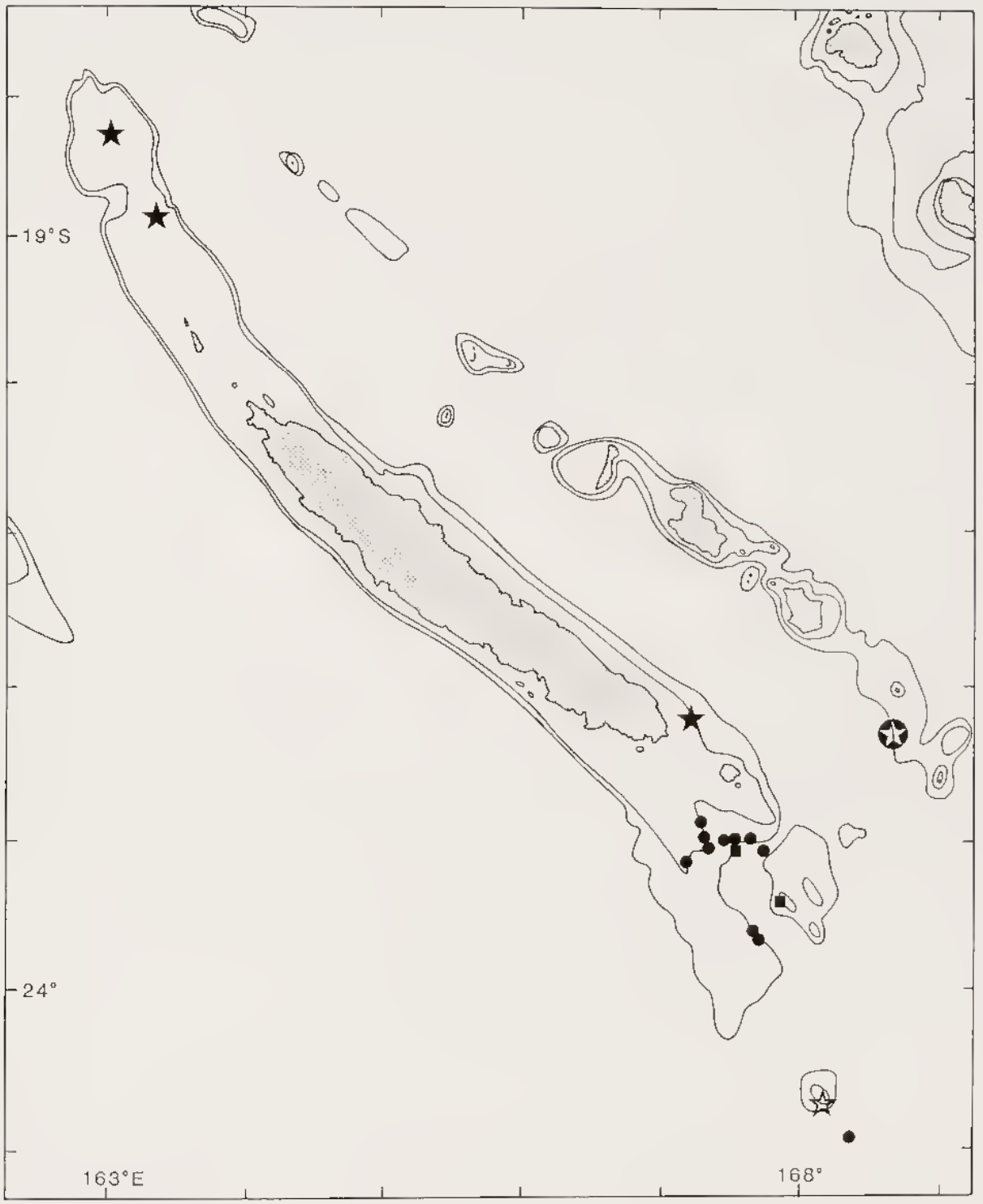

FIG. 158. — Distribution of *Selastele pictum* (✪), *Thysanodonta boncheti* (★), *T. festiva* (☆), *T. opima* (■), and *T. eucosmia* (●).

Source : MNHN, Paris

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Source : MNHN, Paris

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Source : MNHN, Paris

APPENDIX 1

LIST OF GENERA AND SUBGENERA OF CALLIOSTOMATIDAE

CALLIOSTOMATINAE

Akoya Habe, 1961 (*Calliostoma (Calotropsis?) akoya* Kuroda *in* Ikebe, 1942).
Alertalex Dell, 1956 (*Alertalex blacki* Dell, 1956). ? = *Otukaia* Ikebe, 1942.
Ampullotrochus Monterosato, 1890 (*Trochus granulatus* Born, 1778).
Astele Swainson, 1855 (*Astele subcarinata* Swainson, 1855).
Astelena Iredale, 1924 (*Zizyphinus scitulus* A. Adams, 1854).
Bathyfantor gen. nov. (*B. rapuhia* sp. nov.).
Benthastelena Iredale, 1936 (*Benthastelena katherina* Iredale, 1936).
Calliostoma Swainson, 1840 (*Trochus conulus* Linnaeus, 1758).
Calliotropis Oliver, 1926 [Not *Calliotropis* Seguenza, 1903].(*Trochus cunninghami* "Gray, 1834" — *i.e.* Griffith & Pidgeon, 1833 = *Trochus selectus* Dillwyn, 1817). = *Maurea* Oliver, 1926.
Callistoma/Callistomus Herrmannsen, 1846 (emendations of *Calliostoma* Swainson, 1840).
Calotropis Thiele, 1929. Replacement name for *Calliotropis* Oliver not Seguenza. = *Maurea* Oliver, 1926.
Carinator Ikebe, 1942 (*Calliostoma (Carinator) makiyamai* Ikebe, 1942). Type material of *C. makiyamai* has not been seen and the relationships of *Carinator* are uncertain.
Conulus Nardo, 1841 (*Trochus conulus* Linnaeus, 1758). = *Calliostoma* Swainson, 1840 (objective synonym).
Coralastele Iredale, 1930 (*Coralastele allanae* Iredale, 1930).
Dactylastele gen. nov. (*Trochus (Zizyphinus) poupineli* Montrouzier, 1875).
Dymares Schwengel, 1942 (*Calliostoma (Astele) agalma* Schwengel, 1942 = *Calliostoma yucatecanum* Dall, 1881).
Elmerlinia Clench & Turner, 1960 (*Calliostoma jujubinum* Gmelin, 1791).
Eucasta Dall, 1889 (*Calliostoma (Encosta) indiana* Dall, 1889).
Eutrochus A. Adams, 1864 (*Eutrochus perspectivus* A. Adams, 1864 = *Astele subcarinata* Swainson, 1855). = *Astele* Swainson, 1840 (objective synonym).
Falsimargarita Powell, 1951 (*Margarites gemma* Smith, 1915).
Fantor Iredale, 1924 (*Ziziphinus comptus* A. Adams, 1854).
Fautrix gen. nov. (*Fautrix candida* sp. nov.).
Fluxina Dall, 1881 (*Fluxina brunnea* Dall, 1881).
Jacinthinus Monterosato, 1889 (*Trochus conulus* Linnaeus, 1758). = *Calliostoma* Swainson, 1840 (objective synonym).
Kombologion Clench & Turner, 1960 (*Calliostoma bairdii* Verrill & Smith, 1880).
Kingotrochus Thering, 1902 (*Margarita coerulescens* King & Broderip, 1831). = *Photinula* H. & A. Adams, 1854 (objective synonym).
Laetifantor Iredale, 1929 (*Calliostoma trepidum* Hedley, 1907).
Leiotrochus Conrad, 1862 (*Leiotrochus distans* Conrad, 1862).
Maurea Oliver, 1926 (*Trochus tigris* Gmelin, 1791).
Maureilla Oliver, 1926 (*Trochus punctulatus* Martyn, 1784). = *Maurea* Oliver, 1926.
Mucrinops Finlay, 1926 (*Zizyphinus spectabilis* A. Adams, 1855). = *Maurea* Oliver, 1926.
Neocalliostoma Castellanos & Fernandez, 1976 (*Calliostoma militaris* Thering, 1907).
Omphaloukaia Yoshida, 1948 (*Calliostoma (Otukaia) hajimeanum* Yoshida, 1948).
Otukaia Ikebe, 1942 (*Calliostoma kiheiziebisu* Otuka, 1939).
Photina H. & A. Adams *in* A. Adams, 1851 [Not *Photina* Burmeister, 1838]. (*Margarita coerulescens* King & Broderip, 1831). = *Photinula* H. & A. Adams, 1854.
Photinastoma Powell, 1951 (*Trochus taeniatus* Wood, 1828).
Photinula H. & A. Adams, 1854 (*Margarita coerulescens* King & Broderip, 1831).
Salsipotens Iredale, 1924 (*Trochus annillatus* Wood, 1828). = *Astele* Swainson, 1855.
Selastele gen. nov. (*Calliostoma onustum* Odhner, 1924).
Sinutor Cotton & Godfrey, 1935 (*Zizyphinus incertus* Reeve, 1863).
Spicator Cotton & Godfrey, 1935 (*Calliostoma spinulosum* Tate, 1893). = *Laetifantor* Iredale, 1929.
Tristichotrochus Ikebe, 1942 (*Calliostoma aculeatum* Sowerby, 1912). = *Benthastelena* Iredale, 1936.
Tropidotrochus Parodiz, 1977 (*Zizyphinus virginicus* Conrad, 1875).
Venustas Allan, 1926 (*Calliostoma fragile* Finlay, 1923).
Venustas Finlay, 1927 (*Trochus tigris* Gmelin, 1791). = *Maurea* Oliver, 1926 (officially rejected name: ICZN Opinion 479).
Venustatrochus Powell, 1951 (*Venustatrochus georgianus* Powell, 1951).
Ziziphinus Gray, 1842 (*Trochus ziziphinus* Linnaeus, 1758).
Zizyphinus Gray, 1847. Incorrect subsequent spelling of *Ziziphinus*.

Source : MNHN, Paris

THYSANODONTINAE

Carinastele Marshall, 1988 (*Carinastele kristellae* Marshall, 1988).
Herbertina Marshall, 1988 (*Herbertina eos* Marshall, 1988).
Thysanodonta Marshall, 1988 (*Thysanodonta aucklandica* Marshall, 1988).

APPENDIX 2

GENUS GROUP TAXA REMOVED FROM CALLIOSTOMATIDAE

Anceps Kolesnikov, 1939 (*Trochus anceps* Eichwald, 1850) (as subgenus of *Calliostoma*). Judging from illustrations (EICHWALD, 1853: pl. 9, fig. 8; KOLESNIKOV, 1935: pl. 22, figs 31-33; KOJUMDGIEVA, 1969: pl. 28, figs 5-7), the type species seems more likely to be a trochid related to *Cantharidus* Montfort, 1810 (Trochinae: Cantharidini).

Callistele Cotton & Godfrey, 1935 (*Astele calliston* Verco, 1905) (as subgenus of *Astele*). From examination of type (AMS C21490) and additional material. *A. calliston* is a trochid related to *Chlorostoma* Swainson, 1840 (Trochinae: Cantharidini).

Eocalliostoma Haas, 1953 (*Calliostoma interruptum* Cox, 1949). Referred to Proconulinae by COX (1960). HICKMAN & MCLEAN (1990) tentatively treated Proconulinae as a synonym of Calliostomatinae, though there is absolutely no evidence that they are related.

Eurastele Coen, 1946 (*Astele (Eurastele) lusitanica* Coen, 1946). The beachworn holotype of the type species (Hebrew University of Jerusalem No.36757) appears to belong to the local form of *Gibbula cineraria* (Linnè, 1758) known as *Trochus strigosus* Gmelin, 1791 (Trochinae: Gibbulini).

Fenioniana Kolesnikov, 1939 (*Trochus fenionianus* d'Orbigny, 1845) (as subgenus of *Calliostoma*). Judging from illustrations (D'ORBIGNY, 1844: pl. 2, figs 13-15; KOLESNIKOV, 1935: pl.19, figs 49-51), the type species is probably a trochid, perhaps a solarielline.

Kishinewia Kolesnikov, 1935 (*Phasianella bessarabica* d'Orbigny, 1844). Judging from illustrations (D'ORBIGNY, 1844: pl. 3, figs 4-6; KOLESNIKOV, 1935: pl. 26, figs 37-39; WENZ, 1943: fig. 4196; KOJUMDGIEVA 1969: pl. 29, figs 10-13) the narrowly attenuate type species is quite unlike any known calliostomatid. It is probably a trochid related to *Cantharidus*.

Manotrochus Fischer, 1885 (*Trochus unidentatus* Philippi, 1844). Although placed as a synonym of *Calliostoma* (*s. str.*) by CLENCH & TURNER (1960), the type species is clearly referable to *Jujubinus* Monterosato, 1884 (KEEN, 1960) (Trochinae: Cantharidini).

Mazastele Iredale, 1936 (*Trochus glypta* Watson, 1886). *Mazastele* was regarded as a calliostomatine genus by IREDALE (1936) and KEEN (1960), but placed as a synonym of *Calliotropis* Seguenza, 1903 (Trochidae, Eucyclinae) by MARSHALL (1979).

Meniconulus Cossmann, 1918 (*Trochus princeps* Deshayes, 1863). Judging from examination of actual specimens (J. LE RENARD collection, France), the type species is a turbinid.

Montagua Leach *in* Gray, 1852 (*Montagua dannoniensis* Leach, 1852) (not *Montagua* Fleming, 1828). Although placed as a synonym of *Calliostoma* (*s. str.*) by KEEN (1960), according to JEFFREYS (1865: 322) the type species is a synonym of *Jujubinus montagui* (Wood, 1828) (Trochidae). Type material (never illustrated) of *M. dannoniensis* could not be located and since there is nothing in LEACH's (1852) description that would contradict JEFFREYS' (1865) opinion, I regard *Montagua* as a synonym of *Jujubinus*.

Pulchrastele Iredale, 1929 (*Calliostoma (Eutrochus) septemirium* Melvill & Standen, 1899). From examination of type (BMNH 1899.2.23.13) and additional material (AMS) of *C. septenarium*, *Pulchrastele* is related to *Clanculus* Montfort, 1810 (Trochidae, Trochinae).

Putzeysia Sulliotti, 1889 (*Trochus clathratus* Aradas, 1847). Long regarded as a genus of the Calliostomatinae, *Putzeysia* has been conclusively shown to be related to *Danilia* Brusina, 1865 (GUIDASTRI *et al.*, 1984) and it thus belongs in Trochidae, subfamily Eucyclinae.

Sarmates Kolesnikov, 1939 (*Trochus sarmates* Eichwald, 1850). Judging from illustrations (EICHWALD, 1853: pl. 9, fig. 10; KOLESNIKOV, 1935: pl. 23, figs 24-27; KOJUMDGIEVA, 1969: pl. 23, figs 9-10), *T. sarmates* seems most unlikely to be a calliostomatid. Although it is probably a trochid, its relationships within the family are uncertain.

Scrobiculinus Monterosato, 1889 (*Trochus strigosus* Gmelin, 1791). Although *Scrobiculinus* was placed as a subgenus of *Astele* by KEEN (1960), the type species belongs in the trochid genus *Gibbula* (Trochinae: Gibbulini). Incidentally, *Strigosella* Saeco, 1896 has the same type species and is thus an objective synonym.

Source : MNHN, Paris

Sinzowia Kolesnikov, 1935 (*Trochus elatior* d'Orbigny, 1845). The type species (KOLESNIKOV, 1935: pl. 25, figs 31-33; WENZ, 1943: fig. 4197) has an extremely attenuate turriculate spire and, like *Kishinewia*, exhibits no character that would indicate relationship with Calliostomatidae. It is presumably related to *Jujubinus* (Trochidae, Trochinae).

Stylotrochus Seguenza, 1876 (not Haekel, 1862). Regarded as a synonym of *Calliostoma* (*s. str.*) by KEEN (1960). SEGUENZA (1876) introduced *Stylotrochus* with descriptions of four new species, none of which were ever illustrated. The shell was described as being conic-trochiform, with an axially ribbed, styliform, cylindrical apex, a description alien to an archaeogastropod. A search of the European literature for a gastropod fitting the generic diagnosis led to JEFFREYS' (1883: 113) discussion of the type species of his new genus *Iphitus* (*I. tuberatus* Jeffreys, 1883), in which he stated that he had received a similar shell from SEGUENZA from the Lower Pliocene of Messina under the manuscript name *Gemmula aspernta*. This is probably the specimen so-labelled in the JEFFREYS' collection (USNM 186200), and clearly represents *Stylotrochus asperatus* Seguenza, 1876. Since this specimen is a species of *Iphitus*, *Stylotrochus* is a hitherto overlooked senior synonym of *Iphitus*, though a homonym. Incidentally, since the USNM specimen of *S. asperatus* is presumably a syntype it represents a potential lectotype by which the identity of the specific name can be stabilised. *Iphitus* is a genus of the Epitoniidae.

[The present paper was in press when BERTOLASO & PALAZZI (1994) independently published the same results. They failed to indicate, however, that *Stylotrochus* Seguenza, 1876 is preoccupied by *Stylotrochus* Haekel, 1862].

Source : MNHN, Paris

6

The Trophoninae (Gastropoda: Muricidae) of the New Caledonia region

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ABSTRACT

New Caledonian representatives of the muricid subfamily Trophoninae are revised. Two new genera are described and a total of 32 species are recorded, of which 24 are new to science. One species is refered to *Apixystus* Iredale, 1929, four to *Trophonopsis* Bucquoy & Dautzenberg, 1882, twenty-two to *Leptotrophon* n. gen., four to *Conchatalos* n. gen., and one to *Litozamia* Iredale, 1929. Two species formerly described in *Poirieria* (*Paziella*) (Muricinae) are transfered to Trophoninae. Three species are also known from SE and E Australia, and/or from Indonesia. The others are known only from the New Caledonian region. Most species live between 250 and 775 meters; only one species occurs in 105-110 m and three range deeper than 1000 m.

RÉSUMÉ

Les Trophoninae (Gastropoda: Muricidae) de la région néo-calédonienne.

Une faune très particulière de Trophoninae a été découverte lors des différentes campagnes de dragages dans la région néo-calédonienne. L'étonnante diversité de forme et de sculpture de la coquille est actuellement sans équivalent dans les autres régions du monde. La morphologie de la coquille et de la radula, par comparaison avec les espèces connues, ont conduit à la création des deux nouveaux genres *Leptotrophon* gen. nov. et *Conchatalos* gen. nov. Le premier genre groupe 22 espèces, dont deux décrites auparavant (HOUART, 1986) comme *Poirieria (Paziella)* (Muricinae). Le deuxième genre comprend quatre espèces, dont deux nommées auparavant comme *Trophon* (HOUART, 1991). Quatre espèces sont comprises dans *Trophonopsis* Bucquoy & Dautzenberg, 1882, une dans *Litozamia* Iredale, 1929 et une dans *Apixystus* Iredale, 1929. Vingt-quatre des 32 espèces recensées sont décrites comme nouvelles. Trois espèces sont connues également d'Australie et/ou d'Indonésie, les autres proviennent uniquement de la région néo-calédonienne. La plupart des espèces vivent entre 250 et 775 m de profondeur ; une espèce a été récoltée à 105-110 m et trois à plus de 1000 m de profondeur.

HOUART, R., 1995. — The Trophoninae (Gastropoda: Muricidae) of the New Caledonia region. *In*: P. BOUCHET (ed.). Résultats des Campagnes MUSORSTOM, Volume 14. *Mém. Mus. natn. Hist. nat.*, 167. 459-498. Paris ISBN 2-85653-217-9.

Published 29th December 1995.

Source : MNHN, Paris

INTRODUCTION

The subfamily Trophoninae has never been studied thoroughly so far, except in some local faunistic reports and revisions. The exact number of Recent species referable to the subfamily is unknown, but it is estimated here to be 210-215, including the new species described below.

Trophoninae is here used in a traditional way, to include typical "*Trophon*-like" species. However, in a recent paper, KOOL (1993), demonstrated that *Trophon geversianus* (Pallas, 1774), the type species of Trophoninae, is closely related to *Nucella* and *Oceuebra*. He concluded that future studies may show that Trophoninae is not a monophyletic group and that a new name for its members may be warranted. It is thus likely that all of the species included in the present paper will eventually have to be transfered from the Trophoninae to another subfamily.

Thanks to Dr Philippe BOUCHET (MNHN), I have the opportunity to examine material of the family Muricidae collected in the New Caledonian region during several deep-sea cruises, and I now have the privilege of recording a total of 32 species of Trophoninae, including 24 new species. There are a further 8 specimens, representing 6 or 7 unidentified species, in the material. They are not included here because of a need of additional material, or because the specimens are damaged or juveniles known from a single specimen. Six species have already been described from New Caledonia (HOUART, 1986, 1990, 1991). Two of them were originally included in the subfamily Muricinae due to resemblances of the shells to those of species of *Paziella* Jousseaume, 1880. Their radula, unknown to me at that time, proves to be trophonine, while additional material was most useful and decisive for the present classification. Two other previously described species that have not yet been recorded from New Caledonia are here included: *Trophon plicilamellatus* Verco, 1909, and *Trophon obtuseliratus* Schepman, 1911.

When I started working on the present material, I was astonished of the number of specimens of the species I had previously (HOUART, 1986) believed to belong to *Paziella*, which in 1986 were known only from 4 specimens in New Caledonia. After a more careful examination I recognized not only additional specimens of the hitherto known species, but also a considerable number of additional taxa, mostly from the north or the south of New Caledonia, but also off the Loyalty Islands and the Chesterfield Reefs. Finally I separated the whole group into 22 species: 20 new species here described plus *Paziella spinacutus* Houart, 1986 and *Paziella acerapex* Houart, 1986. The species are distinctive in their small size, and in the remarkable stability of the shape of the aperture (see descriptions) and radular morphology. Study of the radula also permits separation of the species from *Paziella*, in which the radula is quite different (RADWIN & D'ATTILLIO, 1976: 86, fig. 50 and HARASEWYCH, 1984: 18, fig. 27). The species were compared with others included in a variety of genera, such as *Anatrophon, Apixystus, Benthoxystus,* and *Gemixystus* (all of Iredale, 1929), *Comptella* Finlay, 1927, *Xymene* Iredale, 1915, and *Trophonopsis* Bucquoy & Dautzenberg, 1882.

Four other species, 2 of which (HOUART, 1991) were originally refered to *Trophon* Montfort, 1810, and 2 new species described herein, are grouped in a new genus.

Some of the species included in the new genera appear to have very restricted distributions, while others are widely distributed in the study area. Thirteen are known only from southern New Caledonia, 6 in the northern region, 2 from Chesterfield Reefs, and 5 from two or more geographical areas.

Some species have been collected in close proximity but at different depths and have not been proven to occur sympatrically. However, 20 species are sympatric with one or several other species, 17 hauls containing combinations of 2-4 different species (Table 1).

Except for one or two shells, it is also remarkable to observe the almost total lack of intraspecific variability, even for species with wide distributions.

Source : MNHN, Paris

TABLE 1. — Sympatric occurrence species of *Leptotrophon* and *Conchatalos* by cruise and station.

BIOCAL	
stn DW 08	*L. caledonicus*, *L. surprisensis*
stn DW 33	*L. charcoti*, *C. tirardi*
stn DW 38	*L. acerapex*, *L. inaequalis*
stn DW 44	*L. acerapex*, *L. caroae*, *C. lacrima*
stn DW 46	*L. caroae*, *L. surprisensis*
stn DW 48	*L. spinacutus*, *L. charcoti*
LAGON	
stn 444	*L. surprisensis*, *L. protocarinatus*
MUSORSTOM 4	
stn DW 156	*L. lineorugosus*, *L. rigidus*
stn DW 161	*L. lineorugosus*, *L. richeri*
stn DW 162	*L. surprisensis*, *L. marshalli*
stn DW 164	*L. caledonicus*, *L. virginiae*, *L. minispinosus*
stn DW 196	*L. surprisensis*, *L. marshalli*
stn DW 197	*L. lineorugosus*, *L. surprisensis*
stn DW 220	*L. bernadettae*, *C. tirardi*
stn DW 221	*L. bernadettae*, *L. charcoti*, *C. tirardi*
stn DW 222	*L. spinacutus*, *L. acerapex*, *L. bernadettae*, *C. vaubani*
CHALCAL 2	
stn DW 76	*L. metivieri*, *C. canalibrevis*

ABBREVIATIONS AND TEXT CONVENTIONS

The present study is based on material collected during numerous cruises in the New Caledonian region. For narratives of the cruises and complete stations lists, see RICHER DE FORGES (1990, 1991).

Descriptions. All undoubtedly adult specimens have 5 or more teleoconch whorls, which is usual in species of Trophoninae. The operculum is almost identical in all species, thin and unguiculate, with a subterminal nucleus (Figs 30 to 35).

Remarks. The remarks are almost entirely devoted to the geographical distribution and sympatry of species. All the species are contrasted in Tables 2 and 3.

Repositories

AMS : Australian Museum, Sydney
MNHN : Muséum national d'Histoire naturelle, Paris
NMNZ : Museum of New Zealand, Wellington
NMP : Natal Museum, Pietermaritzburg
NSMT : National Science Museum, Tokyo
RII : Author's collection, Landen
SAM : South Australian Museum, Adelaide
USNM : National Museum of Natural History, Washington, DC
ZMA : Zoölogisch Museum, Amsterdam

Source : MNHN, Paris

Station data

CC : Chalut à crevettes (Shrimp trawl)
CP : Chalut à perche (Beam trawl)
DC : Drague Charcot (Charcot dredge)
DE : Drague Epibenthique (Epibenthic dredge)
DW : Drague Warén (Warén dredge)

Other abbreviations

lv : live-taken specimen(s) present in sample
dd : only empty shell(s) present in sample
OD : Original designation.

SYSTEMATIC ACCOUNT

Family MURICIDAE Rafinesque, 1815

Subfamily TROPHONINAE Cossmann, 1903

Genus *TROPHONOPSIS* Bucquoy & Dautzenberg, 1882

Genus *Trophonopsis* Bucquoy & Dautzenberg *in* Bucquoy, Dautzenberg & Dollfus, 1882: 40. Type species (OD): *Murex muricatus* Montagu, 1803; Recent, Europe.

Trophonopsis plicilaminatus (Verco, 1909)

Figs 37-39

Trophon plicilaminatus Verco, 1909: 335, pl. 24, figs 1-2.

TYPE MATERIAL. — Holotype SAM D13486. Paratype AMS C31093.

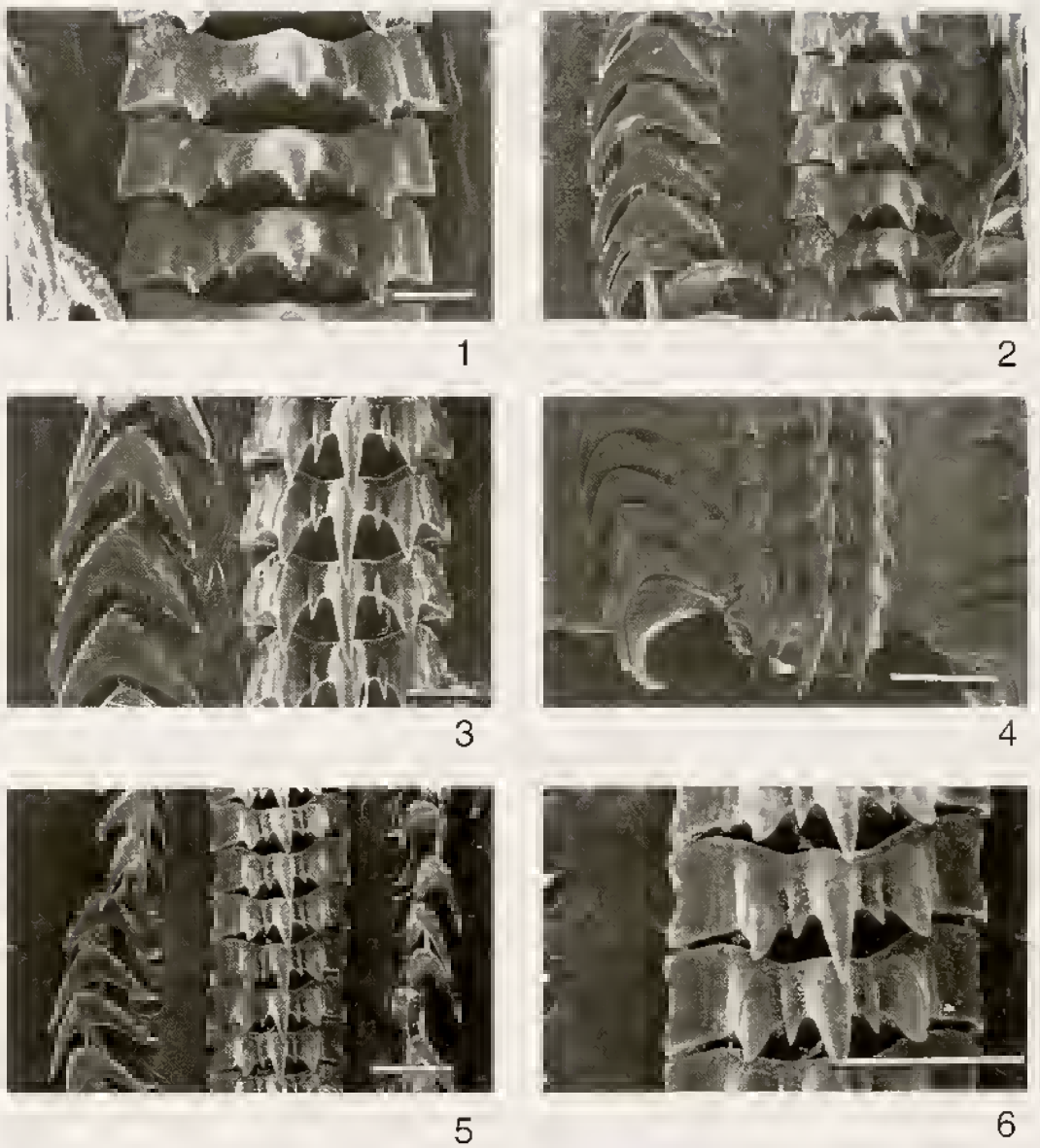
TYPE LOCALITY. — Off Beachport, South Australia, 365-274 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOCAL: stn DW 33, 23°10′ S, 167°10′ E, 675 m, 1 dd. — Stn CP 57, 23°43′ S, 167°59′ E, 1490 m, 2 dd. — Stn CP 61, 24°12′ S, 167°31′ E, 1070 m, 4 dd. — Stn DW 70, 23°25′ S, 167°54′ E, 965 m, 4 dd.
Coral Sea. MUSORSTOM 5: stn DW 322, 21°19′ S, 158°00′ E, 975 m, 5 dd.

DISTRIBUTION. — South Australia (Beachport), in 274-365 m (recorded alive), the Coral Sea, and southern New Caledonia, in 675-1490 m (empty shells).

REMARKS. — Hitherto known only from off Beachport, South Australia in 274-365 m. Only empty shells have been recorded from the New Caledonian region, so that no bathymetric range for living specimens can be given for the Coral Sea and New Caledonia.

Source : MNHN, Paris



FIGS 1-6. — Radulae of Trophoninae. — **1**, *Boreotrophon clathratus* (Linné, 1767), Iceland. Scale line 20 µm. — **2**, *B. clathratus*, Iceland. Scale line 30 µm. — **3**, *B. acceptans* (Barnard, 1959), S. Africa. Scale line 30 µm. — **4**, *Trophonopsis muricatus* (Montagu, 1803), Italy. Scale line 20 µm. — **5-6**, *T. multigradus*, New Caledonia. Scale line 50 µm.

Trophonopsis obtuseliratus (Schepman, 1911)

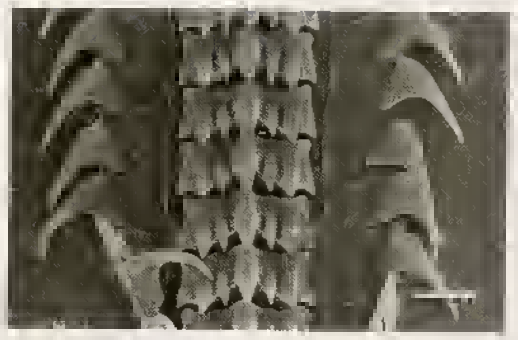
Figs 40-41

Trophon obtuseliratus Schepman, 1911: 338, pl. 21, fig. 1; pl. 24, fig. 5.

TYPE MATERIAL. — Holotype ZMA 3.11.075.

TYPE LOCALITY. — Flores Sea, *"Siboga"*, stn 45, 07°24' S, 118°15' E, 794 m.

Source : MNHN, Paris



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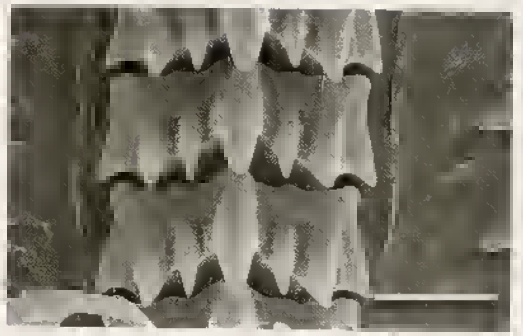

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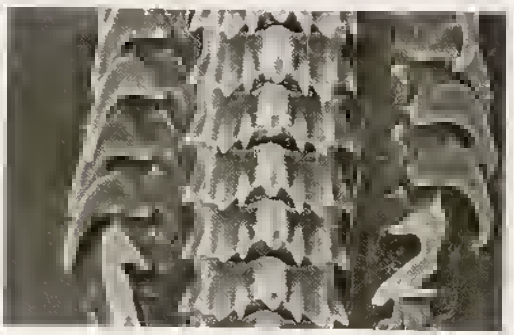

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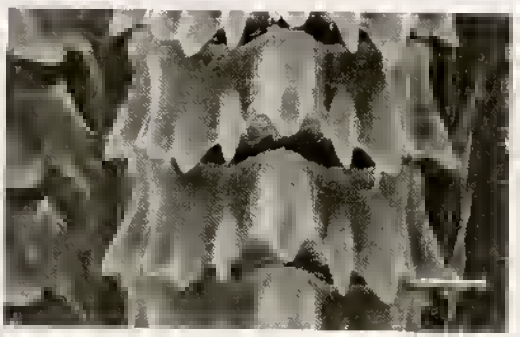

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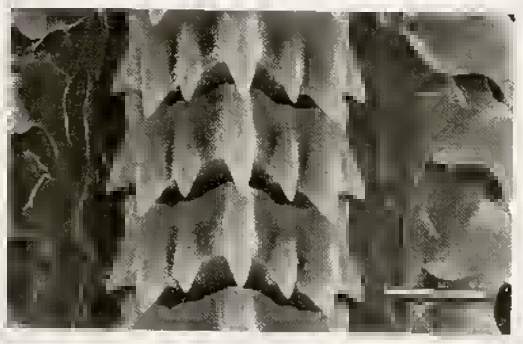

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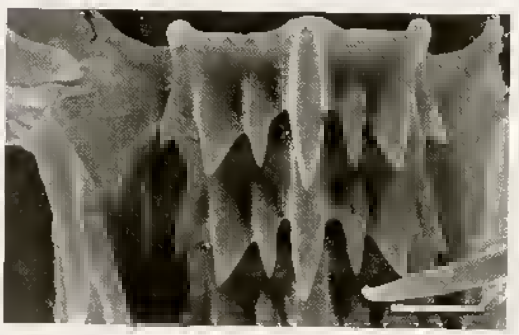

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FIGS 7-14. — Radulae of *Leptotrophon*. — **7-8**, *L. caroae*. — **9-10**, *L. acerapex*. — **11-12**, *L. levii*. — **13-14**, *L. bernadettae*. Scale lines 10 µm.

Source : MNHN, Paris

MATERIAL EXAMINED. — The type material.
Loyalty Basin. BIOGEOCAL: stn CP 260, 21°00′ S, 167°58′ E, 1820-1980 m, 2 lv.
Australia. Off Sydney, NSW, 512 m, 1 lv (RH).

DISTRIBUTION. — Indonesia (Flores, Savu, Banda and Arafura Seas); SE Australia, 420-988 m (COCHRAN, 1985) and the Loyalty Islands, from 1820 to 1980 m (recorded alive).

Trophonopsis minirotundus (Houart, 1986)

Figs 42-43

Trophon (Trophonopsis) minirotundus Houart, 1986: 438, pl. 1, figs 4-4A-B.

TYPE MATERIAL. — Holotype MNHN.

TYPE LOCALITY. — New Caledonia, *"Vauban"* 1978-79, stn 40, 22°30′ S, 166°24′ E, 250-350 m.

DISTRIBUTION. — Off southwestern New Caledonia, 250-350 m (dead recorded).

REMARKS. — Known only from the holotype, which has only 3 teleoconch whorls and is probably a juvenile. Dredgings have been made in the same area during the BIOCAL cruise but at 1550-2080 m, which is probably much too deep for *T. minirotundus* (250-350 m). Dredgings during the "programme LAGON" have also been made in that particular area, but not deeper than 80 meters.

Trophonopsis multigradus (Houart, 1990)

Figs 5-6, 36, 139-140

Trophon multigradus Houart, 1990: 212, figs 13, 18-19, 24-25.

TYPE MATERIAL. — Holotype MNHN. Paratypes: 1 MNHN, 1 AMS C161951, 1 NMNZ MF49874, 1 RH.

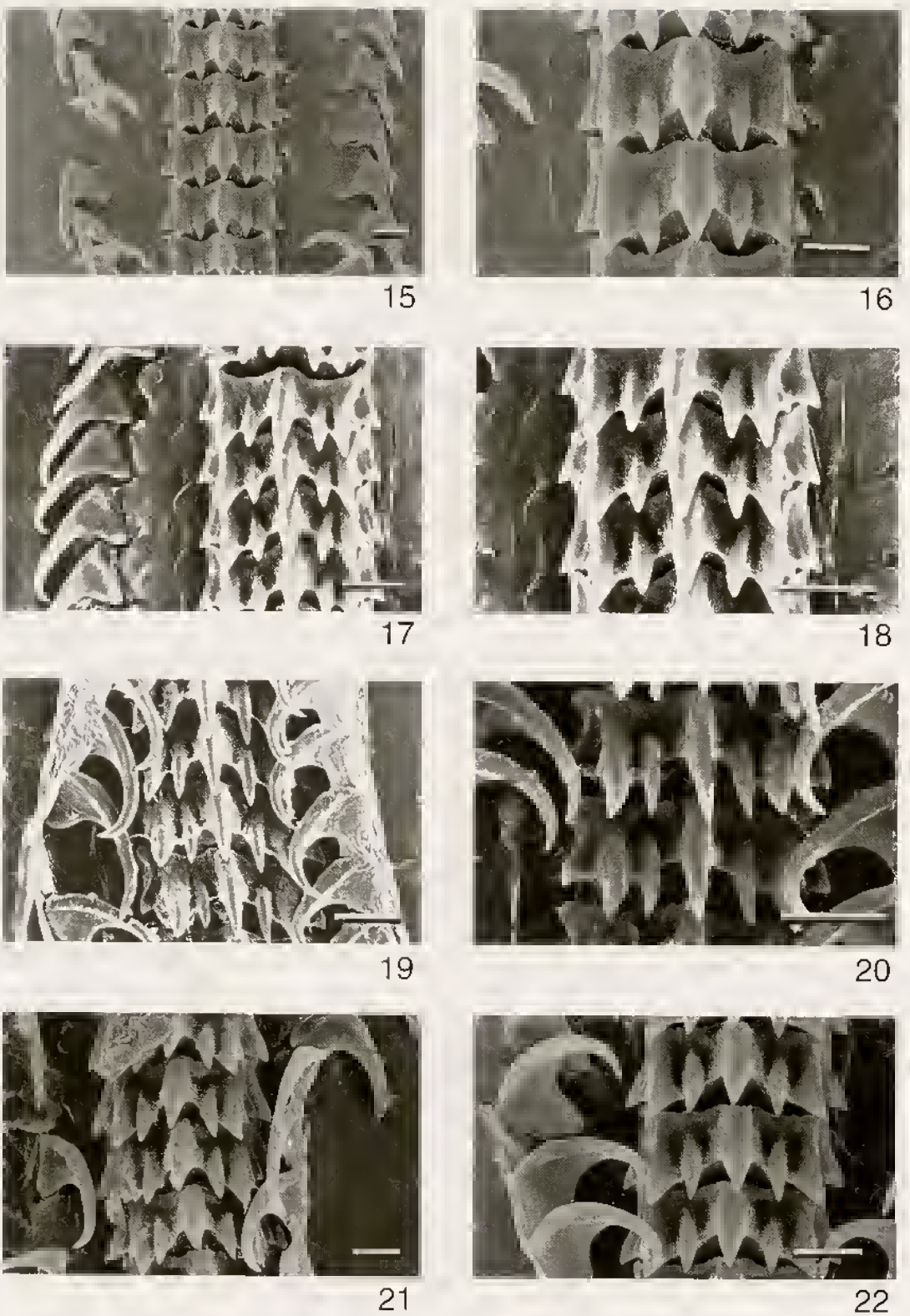
TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn CC 177, 18°55′ S, 163°10′ E, 540-600 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 48, 23°00′ S, 167°29′ E, 775 m, 10 dd. — Stn DW 49, 23°03′ S, 167°32′ E, 825-830 m, 2 dd. — Stn DW 53, 23°09′ S, 167°43′ E, 975-1005 m, 1 dd.
MUSORSTOM 4: stn CP 169, 18°54′ S, 163°11′ E, 590 m, 2 dd (paratypes: 1 AMS, 1 NMNZ). — Stn CC 177, 18°55′ S, 163°10′ E, 540-600 m, 1 dd (holotype MNHN). — Stn DW 197, 18°51′ S, 163°21′ E, 550 m, 1 dd (paratype MNHN). — Stn CP 199, 18°50′ S, 163°14′ E, 595 m, 1 dd (paratype RH).

DISTRIBUTION. — Northern and southern New Caledonia, 540-1005 m. Bathymetric range for live-taken material 540-600 m.

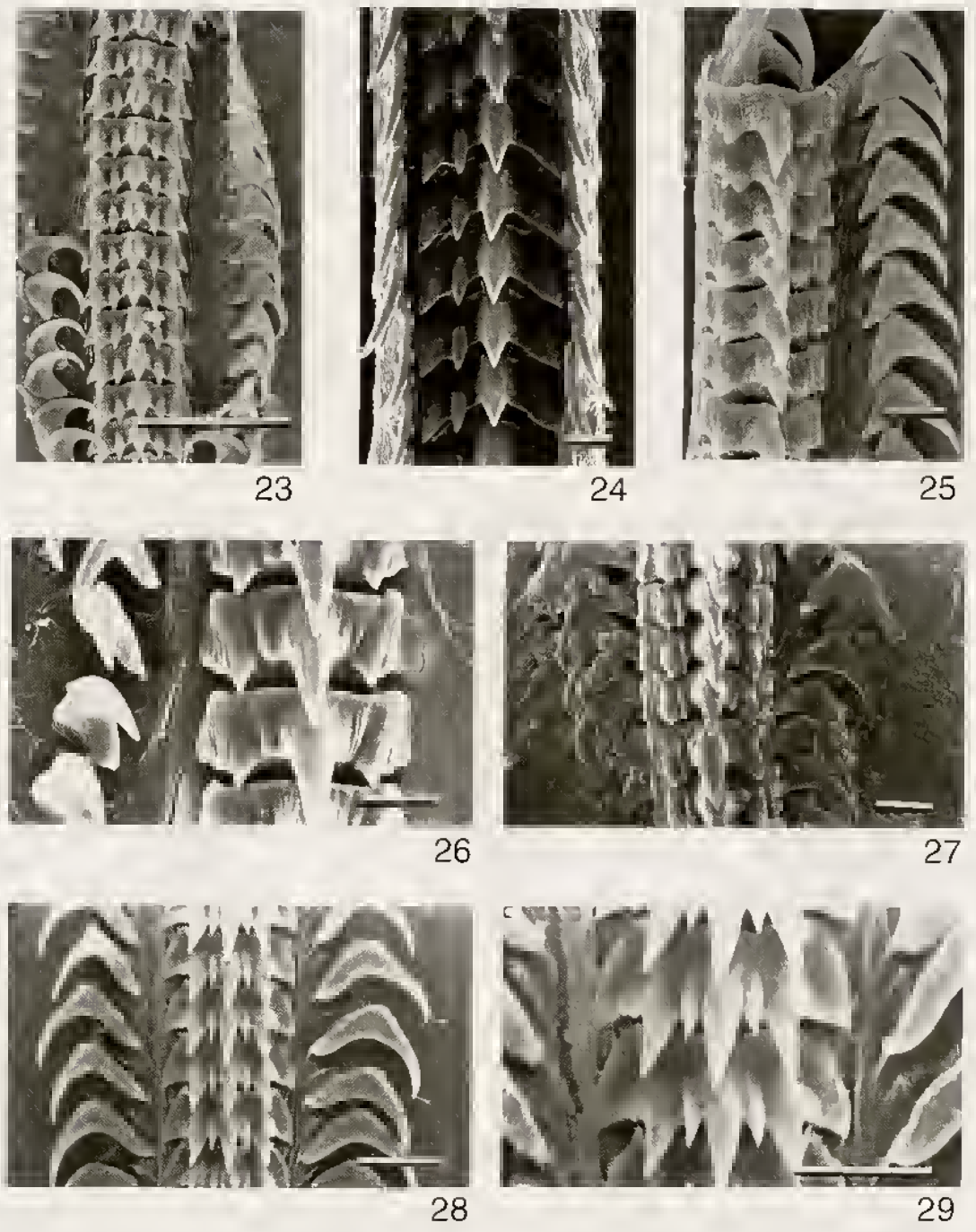
REMARKS. — When originally described, this species was compared with *Trophon obtuseliratus* Schepman, 1911, which has fewer axial lamellae, fewer and weaker spiral cords, and a relatively longer siphonal canal. *T. pulchellus* Schepman, 1911 has fewer, more strongly developed axial lamellae, a more lightly built and more narrowly fusiform shell, and more weakly shouldered whorls. *T. soyoae* (Okutani, 1959), a superficially similar abyssal species from Japan, has a thin, delicate shell, the last whorl having approximately 80 thin axial lamellae and 2 weak spiral cords.

Source : MNHN, Paris



FIGS 15-22. — Radulae of *Leptotrophon*. — **15-16**, *L. lineorugosus*. — **17-18**, *L. coriolis*. — **19-20**, *L. caledonicus*. — **21**, *L. protocarinatus*. — **22**, *L. surprisensis*. Scale lines 10 µm.

Source : MNHN, Paris



FIGS 23-29. — Radulae of *Leptotrophon*, *Conchatalos* and *Apixystus*. — **23**, *Leptotrophon surprisensis*. — **24**, *L. charcoti*. — **25**, *Conchatalos lacrima*. — **26**, *C. tirardi*. — **27**, *C. vaubani*. — **28-29**, *Apixystus leptos*. — 23, scale line 50 µm; 24-29, scale lines 10 µm.

Source : MNHN, Paris

FIGS 30-35. — Opercula of *Leptotrophon* and *Conchatalos*. — **30**, *Leptotrophon caroae*, height 1.6 mm. — **31**, *L. bernadettae*, height 2.6 mm. — **32**, *L. lineorugosus*, height 2.5 mm. — **33**, *L. surprisensis*, height 2.1 mm. — **34**, *L. protocarinatus*, height 2.3 mm. — **35**, *Conchatalos lacrima*, height 2.6 mm.

Genus *LEPTOTROPHON* gen. nov.

Type species: *Leptotrophon caroae* sp. nov. Recent, New Caledonia, Loyalty Ridge, Coral Sea.

DIAGNOSIS. — *Shell* biconical, up to 13.5 mm in length, average length 8-10 mm. Last *teleoconch* whorl with 6-10 axial, lamellate, or occasionally rounded varices. Aperture roundly-ovate with flaring columellar lip and erect outer lip. Siphonal canal straight or occasionally weakly bent, spineless, open. Lateral teeth of *radula* sickle-shaped; rachidian tooth with medium to long, lenticular central cusp, lateral denticles and lateral cusps medium-sized, marginal cusps short to medium-sized. Cusps and denticles all well separated from each other.

REMARKS. — The species of *Leptotrophon* differ from those of *Trophonopsis* in being generally smaller and more delicate, while the flaring columellar lip is another distinctive character. The radula

Source : MNHN, Paris

has a broader base and the rachidian tooth usually has more strongly projecting cusps and denticles (see Figs 1-6 for comparison). Specific characters are compared in Table 2.

ETYMOLOGY. — From *Leptos* (Greek): thin, and *Trophon* (type-genus of the subfamily Trophoninae).

Leptotrophon acerapex (Houart, 1986)

Figs 9-10, 46, 98-99

Poirieria (Paziella) acerapex Houart, 1986: 437, pl. 1, figs 2-2A.

TYPE MATERIAL. — Holotype MNHN.

TYPE LOCALITY. — New Caledonia, *"Vauban"* 1978-79, stn 16, 22°46′ S, 167°12′ E, 390-400 m.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 16, 22°46′ S, 167°12′ E, 390-400 m (holotype MNHN).
BIOCAL: stn DW 37, 23°00′ S, 167°16′ E, 350 m, 5 dd. — Stn DW 38, 23°00′ S, 167°15′ E, 360 m, 2 dd. — Stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 4 lv.
MUSORSTOM 4: stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 2 lv, 1 dd. — Stn DW 227, 22°46′ S, 167°20′ E, 320 m, 1 lv. — Stn unknown, 2 dd.
SMIB 2: stn DW 08, 22°54′ S, 167°13′ E, 435-447 m, 1 dd.
SMIB 4: stn DW 66, 22°56′ S, 167°15′ E, 400-430 m, 1 lv.

DISTRIBUTION. — Southern New Caledonia, 320-450 m. Bathymetric range for live-taken material 400-450 m.

DESCRIPTION. — *Shell* medium sized, up to 12.5 mm in length at maturity, stout, spinose. Spire very high, acute, with 1.5 protoconch whorls and up to 5 broad, weakly shouldered teleoconch whorls. *Protoconch* smooth, glossy, acuminate; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of low, spinose varices. First teleoconch whorl with 8 varices, second with 7 or 8, third and fourth with 7, last whorl with 6 varices bearing 3 medium-sized, acute spines. Other axial sculpture consisting of numerous growth striae. Spiral sculpture of low cords: first to fourth whorls with 1 carinal cord, last whorl with 3 cords, abapically with 1 or 2, low, weak secondary cords. Aperture roundly-ovate. Columellar lip flaring, smooth, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth. Siphonal canal medium sized, straight, smooth. White. Rachidian *radular tooth* with medium sized cusps and denticles; lateral tooth sickle shaped with broad base.

REMARKS. — *Leptotrophon acerapex* lives in a restricted geographical area. Sympatric species are *L. spinacutus*, *L. caroae*, *L. bernadettae*, *L. inaequalis*, *Couchatalos vaubani* and *C. lacrima*.

Leptotrophon spinacutus (Houart, 1986)

Figs 45, 95-96

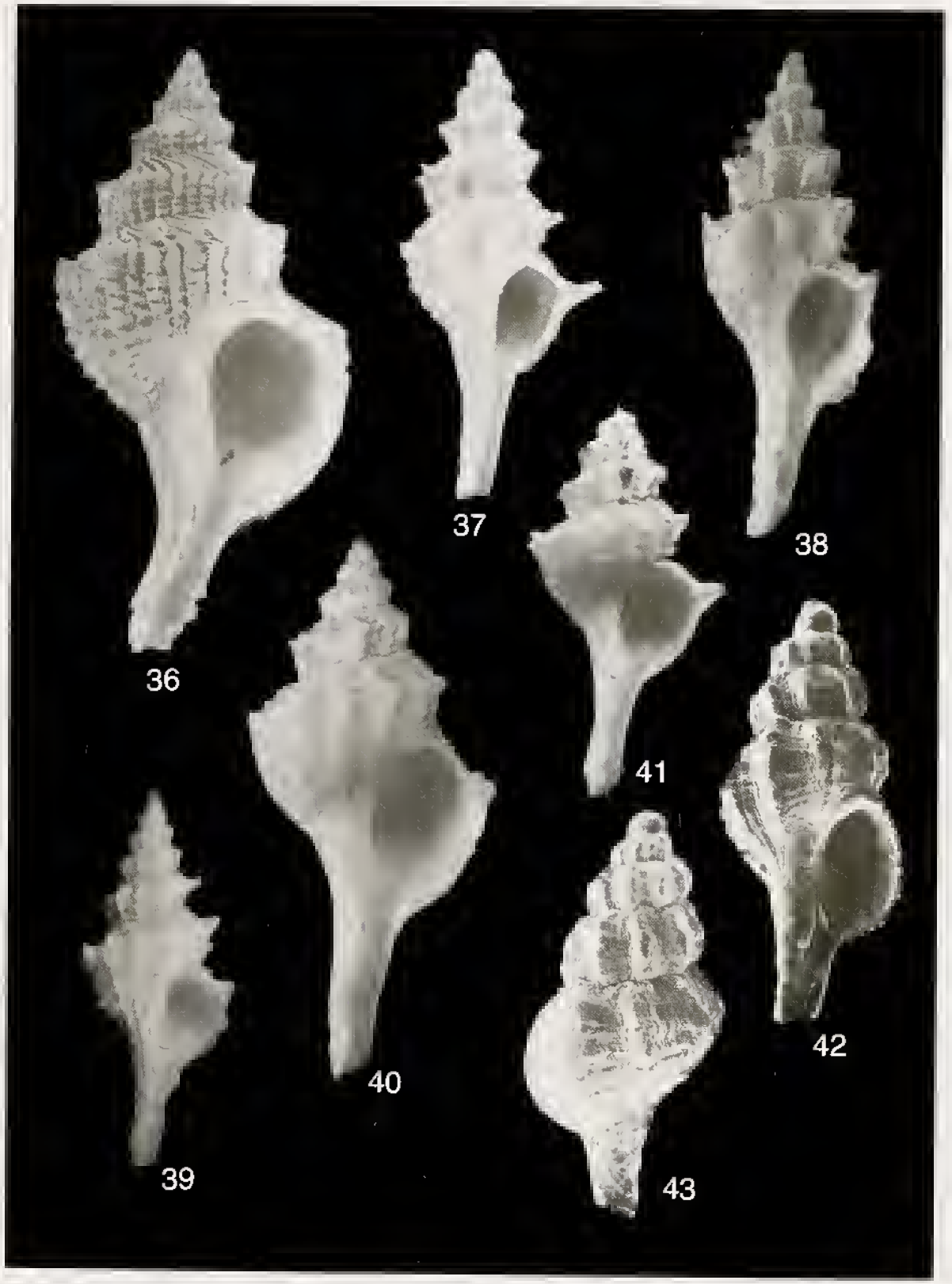
Poirieria (Paziella) spinacutus Houart, 1986: 437, pl. 1, figs 3, 3A-B.

TYPE MATERIAL. — Holotype MNHN. Paratypes: 1 AMS C140734, 1 NMNZ MF34197, 1 RH.

TYPE LOCALITY. — New Caledonia, *"Vauban"* 1978-79, stn 40, 22°30′ S, 166°24′ E, 250-350 m.

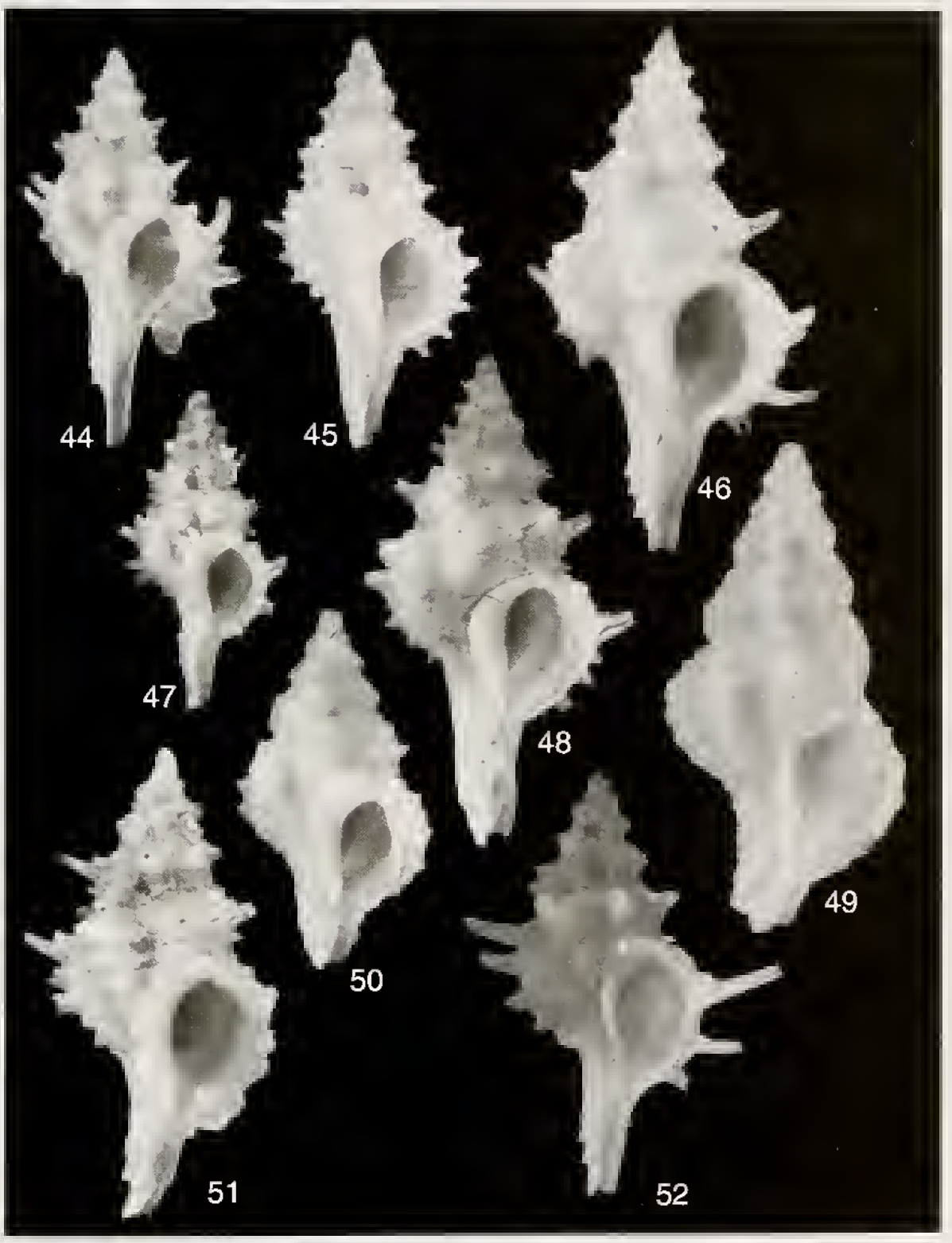
MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 2 (not station 1 as originally noted), 22°17′ S, 167°14′ E, 425-430 m, 1 dd (paratype RH). — Stn 3, 22°17′ S, 167°12′ E, 390 m, 2 dd (paratypes: 1 AMS, 1 NMNZ). — Stn 40, 22°30′ S, 166°24′ E, 250-350 m, 1 dd (holotype MNHN).

Source : MNHN, Paris



FIGS 36-43.-Genus *Trophonopsis*. — 36, *Trophonopsis multigradus*, holotype, 27.5 mm. — **37-39**, *T. plicilamninatus*. — 37, MUSORSTOM 5: stn 322, 10 mm. — 38, paratype AMS C32001, 15.9 mm. — 39, holotype SAM D13486, 14.4 mm. — **40-41**, *T. obtuseliratus*. — 40, holotype ZMA 3.11.075, 32 mm. — 41, BIOGEOCAL: stn CP 260, 13.5 mm. — **42-43**, *T. minirotundus*, holotype, 5 mm.

Source : MNHN, Paris



FIGS 44-52. — Genus *Leptotrophon*. - **44**, *Leptotrophon caroae* sp. nov., holotype, 9.1 mm. — **45**, *L. spinacutus*, MUSORSTOM 4: stn DW 226, 11 mm. — **46**, *L. acerapex*, BIOCAL: stn DW 44, 12.5 mm. — **47**, *L. levii* sp. nov., holotype, 7 mm. — **48**, *L. rigidus* sp. nov., holotype, 11.5 mm. — **49-50**, *L. caledonicus* sp. nov. — 49, holotype, 12.2 mm. — 50, BIOCAL: stn DW 08, 8.5 mm. — **51**, *L. bernadettae* sp. nov., holotype, 11 mm. — **52**, *L. charcoti* sp. nov., holotype, 13 mm.

Source : MNHN, Paris

BIOCAL: stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 4 lv. — Stn DW 48, 23°00′ S, 167°29′ E, 775 m, 2 dd.
MUSORSTOM 4: stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 1 dd. — Stn DW 226, 22°47′ S, 167°22′ E, 390 m, 16 dd.
Loyalty Ridge. SMIB 5: stn DW 91, 22°18′ S, 168°41′ E, 340 m, 1 lv.

DISTRIBUTION. — New Caledonia, 340-610 m (recorded alive).

DESCRIPTION. — *Shell* up to 12 mm in length, heavy, spinose. Spire very high with 1.5 protoconch whorls and up to 5 weakly convex, spinose teleoconch whorls. *Protoconch* rounded, smooth, glossy; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of rounded, spinose varices. First whorl with 8 or 9 varices, second to fourth whorl with 8 varices, last whorl with 7 varices bearing 5 or occasionally 6 short, open spines. Spiral sculpture consisting of rounded cords, 1 on first and second whorl, 2 on third whorl; 3, including 1 on shoulder on fourth whorl; 5 or 6, including 1 on shoulder on last whorl; occasionally with secondary cords on last and penultimate whorls. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth. Siphonal canal medium sized, narrow, straight, narrowly open, with 4 or 5 low spiral cords. Whitish, with occasional brown blotches between spiral cords, especially on varices. *Radula* unknown.

REMARKS. — This species lives sympatrically with *L. acerapex*, *L. charcoti*, and *Conchatalos vanbani*.

Leptotrophon caroae sp. nov.

Figs 7-8, 30, 44, 91-92

TYPE MATERIAL. — Holotype MNHN. Paratypes: 213 MNHN, 2 AMS C301327, 2 NMNZ M262667, 2 NMP L1155, 2 USNM 860393, 2 RH.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 44, 22°47′ S, 167°14′ E, 440-450 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 223 lv & dd (holotype and paratypes). — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 18 lv & dd. MUSORSTOM 4: stn DW 230, 22°52′ S, 167°12′ E, 390-420 m, 1 lv.

DISTRIBUTION. — Off Southern New Caledonia, 390-610 m (recorded alive).

DESCRIPTION. — *Shell* up to 9.3 mm in length at maturity, spinose, lightly built. Spire high with 1.5 protoconch whorls and up to 5 shouldered teleoconch whorls. *Protoconch* whorls rounded, smooth, glossy; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of thin, lamellate, somewhat spinose varices. First and second whorls with 8 varices, third whorl with 7 or 8 varices, fourth with 7 varices, last whorl with 6 or 7 varices with broad, thin, abapical webbing. Varices of last whorl with 4 medium-sized, weakly adaperturally bent, open spines. Shoulder spine longest. Other axial sculpture of numerous, delicate, fine growth striae. Spiral sculpture consisting of weak, equal-sized, rounded cords: 1 on first whorl, 1 or 2 on second, 2 on third and fourth whorl, 5, including 1 on shoulder, on last whorl, carinal cord strongest. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, weakly adherent at adapical extremity. Anal notch shallow, broad. Outer lip strongly erect, smooth. Siphonal canal long, narrow, straight, narrowly open, smooth. Translucent white. Rachidian *radular tooth* with medium sized cusps and denticles, lateral teeth sickle shaped with broad base.

REMARKS. — *Leptotrophon caroae* lives in a restricted area to the south of New Caledonia where it is sympatric with *L. acerapex*, *L. surprisensis* and *Conchatalos lacrima*. It differs from other species of *Leptotrophon* in its abapertural webbing.

ETYMOLOGY. — Named after my daughter Caroline (Caro), whose help is always welcome.

Source : MNHN, Paris

Leptotrophon lineorugosus sp. nov.

Figs 15-16, 32, 55, 102-103

TYPE MATERIAL. — Holotype MNHN. Paratypes: 6 MNHN, 1 NMNZ M262668, 1 RH.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 159, 18°46′ S, 163°16′ E, 585 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DC 388, 20°45′ S, 160°54′ E, 500-510 m, 1 dd.
CORAIL 2: stn DE 16, 20°48′ S, 160°56′ E, 500 m, 1 lv.
New Caledonia. MUSORSTOM 4: stn DW 156, 18°54′ S, 163°19′ E, 525 m, 2 dd (paratypes). — Stn DW stn DW 159, 18°46′ S, 163°16′ E, 585 m, 1 lv (holotype), 4 lv & dd (paratypes: 2 MNHN, 1 NMNZ, 1 RH). Stn DW 161, 18°39‘ S, 163°11‘ E, 550 m, 1 dd (paratype). — Stn DW 197, 18°51‘ S, 163°21′ E, 550 m, 1 lv (paratype).

DISTRIBUTION. — Chesterfield Reefs and northern New Caledonia, 500-585 m (recorded alive).

DESCRIPTION. — *Shell* up to 10.9 mm in length, heavy. Spire high, with 1.5 protoconch whorls and up to 5 broadly convex, squamous teleoconch whorls. *Protoconch* whorls rounded, smooth, glossy; terminal varix low, delicate. *Teleoconch* suture weakly impressed. Axial sculpture consisting of strong, rounded, squamous, ribs. First to fourth whorls with 9 ribs. Last whorl with 7 or 8 ribs. Other axial sculpture of minutely squamous growth lirae. Spiral sculpture consisting of narrow, squamous cords: 3 on first whorl, 4 or 5 on second, 8 or 9 on third and fourth whorls, last whorl with 17-19 cords. Shoulder with 2-4 cords from second to last whorl. Spiral cords intersecting growth lirae to produce a squamous appearance. Aperture ovate. Columellar lip flaring, smooth, occasionally with small node at middle, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth, weakly lirate within. Siphonal canal medium sized, narrow, straight, narrowly open, with some weak spiral cords adaperturally; abaperturally smooth. White. Rachidian *radular tooth* with medium sized-cusps and denticles. Lateral teeth sickle shaped with broad base.

REMARKS. — *Leptotrophon lineorugosus* lives sympatrically with *L. rigidus*, *L. surprisensis* and *L. richeri*.

ETYMOLOGY. — From *linea* (Latin) = cord, and *rugosus* (Latin) = rugose.

Leptotrophon levii sp. nov.

Figs 11-12, 47, 93-94

TYPE MATERIAL. — Holotype MNHN. Paratypes: 89 MNHN, 2 AMS C301328, 2 NMNZ M262669, 2 NMP L1156/T1191, 2 USNM 860394, 2 RH.

TYPE LOCALITY. — New Caledonia, CHALCAL 2, stn DW 72, 24°55‘ S, 168°22′ E, 527 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 92 lv & dd (paratypes: 82 MNHN, 2 AMS, 2 NMNZ, 2 NMP, 2 USNM, 2 RH).
SMIB 3: stn DW 01, 24°56′ S, 168°22‘ E, 520 m, 3 lv.
CHALCAL 2: stn DW 72, 24°55‘ S, 168°22′ E, 527 m, 1 lv (holotype), 7 lv & dd (paratypes).

DISTRIBUTION. — Southern New Caledonia, 505-527 m (recorded alive).

DESCRIPTION. — *Shell* up to 7.9 mm in length, spinose, lightly built. Spire very high with 1.5 protoconch whorls and up to 5 narrowly convex, spinose teleoconch whorls. *Protoconch* whorls rounded, smooth, glossy; terminal varix low, delicate. *Teleoconch* axial sculpture consisting of lamellose, spinose varices. First and second whorls with 8 varices, third whorl with 9 varices, fourth and last whorls with 8 or 9 varices. Spiral sculpture of very low cords, almost or

Source : MNHN, Paris

completely obsolete on last whorl, 2 cords on first to third whorl, 3 on fourth, including 1 on shoulder, 4 or 5 on last whorl, including 1 on shoulder. Cords ending as broadly open, somewhat blunt spines on varices. Aperture ovate. Columellar lip flaring, smooth, completely erect. Anal notch shallow, broad. Outer lip erect, smooth, with 1 small node within abapically. Siphonal canal medium sized, narrow, weakly abaperturally bent, narrowly open, smooth except numerous axial growth striae. White or translucent white. Raehidian *radular tooth* with medium sized cusps and denticles. Lateral teeth sickle shaped, with broad base.

REMARKS. — A small species with which no similar species is known to be sympatric. *L. biocalae* occurs in the vicinity but at shallower depths.

ETYMOLOGY. — Named after Claude LÉVI, senior scientist of the BIOCAL cruise.

Leptotrophon rigidus sp. nov.

Figs 48, 100-101

TYPE MATERIAL. — Holotype MNHN. Paratypes: 12 MNHN, 1 AMS C301329, 1 NMNZ M262670, 1 NMP L1157/T1192, 1 RH.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn CC 247, 22°09′ S, 167°13′ E, 435-460 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn CC 246, 22°08′ S, 167°11′ E, 410-420 m, 3 dd. — Stn CC 247, 22°09'S, 167°13′ E, 435-460 m, 1 lv (holotype), 2 dd (paratypes).
BIOCAL: stn DW 77, 22°15′ S, 167°15′ E, 440 m, 14 dd (paratypes: 10 MNHN, 1 AMS, 1 NMNZ, 1 NMP, 1 RH).
Loyalty Basin. BIOGEOCAL: stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 11 dd.

DISTRIBUTION. — Eastern and southeastern New Caledonia, 310-460 m. Bathymetric range for live-taken material 435-460 m.

DESCRIPTION. — *Shell* up to 13.5 mm in length, heavy, spinose. Spire high with 1.5 protoconch whorls and up to 5 shouldered, angulate, teleoconch whorls. *Protoconch* whorls rounded, weakly elongate, smooth; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of spinose varices. First and second whorls with 7 or 8 varices, third and fourth whorls with 7 varices; last whorl with 6 varices, each with a long, narrowly open shoulder spine, followed abapically by 4 or 5 small, open spinelets. Earlier whorls with rather long shoulder spines. Spiral sculpture of rounded cords, 2 on first to third whorls, 3 or 4 on fourth, including 1 or 2 low cords on shoulder, last whorl with one heavy carinal cord, and 4 or 5 smaller cords abapically; shoulder with 2 or 3 low cords. Aperture ovate. Columellar lip flaring, smooth but small, elongate node, almost in the middle of the lip. Anal notch shallow, broad. Outer lip erect, smooth, weakly lirate for short distance within. Siphonal canal long, narrow, straight, narrowly open, smooth. Transluscent white. *Radula* unknown.

REMARKS. — *Leptotrophon rigidus* lives sympatrically with *L. lineorugosus* in southern New Caledonia only.

ETYMOLOGY. — *Rigidus* (Latin) = stiff.

Leptotrophon bernadettae sp. nov.

Figs 13-14, 31, 51, 104-105

TYPE MATERIAL. — Holotype MNHN. Paratypes: 14 MNHN, 1 AMS C301330, 1 NMNZ M262671, 1 NMP L1158/T1193, 1 RH.

Source : MNHN, Paris

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 221, 22°59′ S, 167°37′ E, 535-560 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 220, 22°58′ S, 167°38′ E, 505-550 m, 7 lv & dd (paratypes: 3 MNHN, 1 AMS, 1 NMNZ, 1 NMP, 1 RH). — Stn DW 221, 22°59′ S, 167°37′ E, 535-560 m, 1 lv (holotype) and 10 lv & dd (paratypes). — Stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 1 lv (paratype).

DISTRIBUTION. — Southern New Caledonia, 410-560 m (recorded alive).

DESCRIPTION. — *Shell* up to 12 mm in length at maturity, spinose, lightly built. Spire high with 1.5-1.75 protoconch whorls and up to 5 convex, spinose, teleoconch whorls. *Protoconch* acute, whorls smooth, glossy; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of spinose varices. First whorl with 7 varices, second with 8, third whorl with 8 or 9, fourth with 9 or 10, last whorl with 8-10 varices. Varices of last whorl with a long, open, shoulder spine, abapically followed by 4 smaller, open spinelets. Spiral sculpture consisting of rounded, squamous cords: 2 cords from first to third whorl, 3 on fourth whorl, 5, including 2 or 3 weak cords on shoulder, on last whorl. Aperture ovate. Columellar lip flaring, smooth, lip almost completely erect, weakly adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth, a small node within at abapical extremity. Siphonal canal medium sized, narrow, straight or weakly abaperturally bent, narrowly open, smooth. Translucent white. Rachidian *radular tooth* with long, elongate, central cusp and medium-sized lateral denticles and marginal cusps. Lateral teeth sickle shaped.

REMARKS. — This very spinose species lives in a restricted area, occurring sympatrically with *Leptotrophon spinacutus*, *L. acerapex*, *L. tirardi*, *L. charcoti*, and *Conchatalos vaubani*, all of which have a wider geographic distribution.

ETYMOLOGY. — Named after Bernadette CHARLES (MNHN), for her dedication and patience as copy editor of Mémoires du Muséum national d'Histoire naturelle.

Leptotrophon caledonicus sp. nov.

Figs 19-20, 49-50, 97

TYPE MATERIAL. — Holotype and 2 paratypes MNHN.

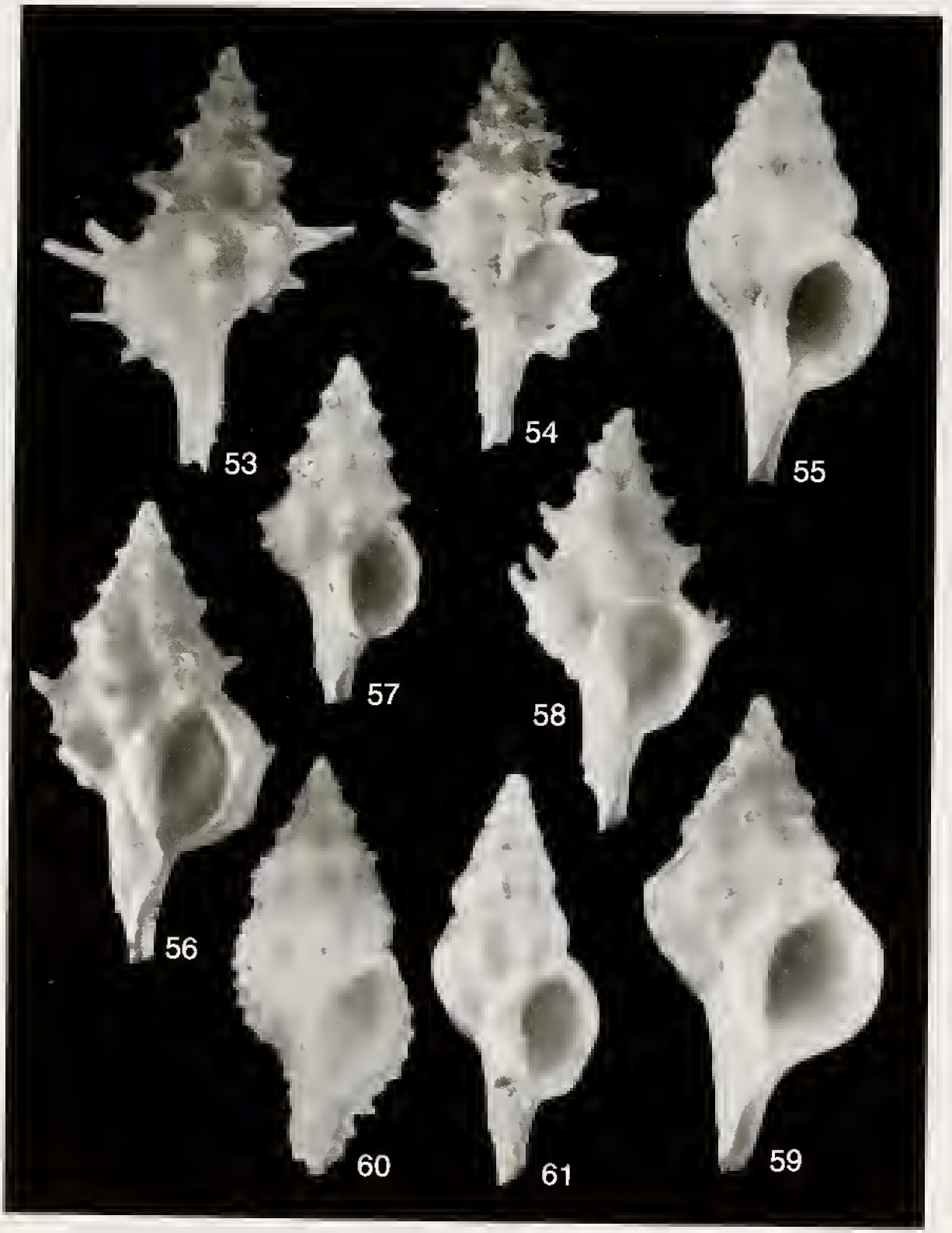
TYPE LOCALITY. — New Caledonia, SMIB 2, stn DW 23, 22°31′ S, 167°37′ E, 410-420 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 08, 20°34′ S, 166°54′ E, 435 m, 2 lv, 2 dd.
MUSORSTOM 4: stn DW 164, 18°33′ S, 163°13′ E, 255 m, 2 dd.
SMIB 2: stn DW 23, 22°31′ S, 167°37′ E, 410-420 m, 1 lv (holotype).
CHALCAL 2: stn DW 76, 23°41′ S, 167°45′ E, 470 m, 1 dd (paratype). — Stn DW 77, 23°38′ S, 167°43′ E, 435 m, 1 dd (paratype).
Loyalty Islands. BIOGEOCAL: stn DW 291, 20°34′ S, 166°54′ E, 510-520 m, 1 lv, 7 dd.
MUSORSTOM 6: stn DW 399, 20°42′ S, 167°00′ E, 282 m, 1 lv, 4 dd. — Stn DC 402, 20°30′ S, 166°49′ E, 520 m, 1 dd. — Stn DW 410, 20°38′ S, 167°07′ E, 490 m, 1 lv. — Stn DW 459, 21°01′ S, 167°31′ E, 425 m, 18 lv & dd.

DISTRIBUTION. — Northern and southern New Caledonia, and Loyalty Islands, 255-520 m. Bathymetrical range for live-taken material 282-520 m.

DESCRIPTION. — *Shell* up to 12.2 mm in length, heavy. Spire high with 1.5 protoconch whorls and up to 5 broadly convex, weakly shouldered teleoconch whorls. *Protoconch* whorls rounded, minutely striate; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of spineless or very weakly spinose rounded varices. First to fourth whorls with 8 varices, last whorl with 7 varices. Spiral sculpture of weak, narrow cords: 1 on first and second whorl, 1 or 2 on third whorl, 3 on fourth whorl, including 1 on shoulder, 7 on last whorl, including 2 on shoulder. Aperture

Source : MNHN, Paris



FIGS 53-61. — Genus *Leptotrophon*. — **53-54**, *Leptotrophon charcoti* sp. nov. — 53, holotype, 13 mm. — 54, paratype MNHN, BIOCAL: stn DW 51, 12.4 mm. — **55**, *L. lineorugosus* sp. nov., holotype, 10.9 mm. — **56-59**, *L. surprisensis* sp. nov. — 56, holotype, 15 mm. — 57, Atoll de Surprise, LAGON: stn 444, 7.9 mm. — 58, MUSORSTOM 4: stn DW 162, 12 mm. — 59, paratype MNHN, MUSORSTOM 4: stn DW 181, 11 mm. — **60**, *L. virginiae* sp. nov., holotype, 8 mm. — **61**, *L. marshalli* sp. nov., holotype, 9 mm.

Source : MNHN, Paris

ovate. Columellar lip flaring, smooth or with 2 small denticles abapically, rim partially erect, weakly adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth, with 4 or 5 elongate denticles within, or smooth. Siphonal canal short, narrow, narrowly open, with 3-5 weak spiral cords. White or pinkish white. Rachidian *radular tooth* with long cusps and denticles. Lateral teeth sickle shaped.

REMARKS. — *Leptotrophon caledonicus* lives sympatrically North of New Caledonia with *L. virginiae* and *L. minispinosus*. It occurs with *L. surprisensis* off the Loyalty Islands.

ETYMOLOGY. — *Caledonicus*: from (New) Caledonia.

Leptotrophon charcoti sp. nov.

Figs 24, 52-54, 108-109

TYPE MATERIAL. — Holotype MNHN. Paratypes: 33 MNHN, 2 AMS C301331, 2 NMNZ M262672, 2 NMP L1159/T1194, 2 USNM 860395, 2 RH.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 51, 23°05′ S, 167°45′ E, 680-700 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 33, 23°10′ S, 167°10′ E, 675-680 m, 19 lv & dd. — Stn DW 48, 23°00′ S, 167°29′ E, 775 m, 2 lv & 4 dd. — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 1 lv (holotype) and 43 lv & dd (paratypes: 33 MNHN, 2 AMS C301331, 2 NMNZ, 2 NMP, 2 USNM, 2 RH). — Stn DW 83, 20°35′ S, 166°54′ E, 460 m, 1 dd.
MUSORSTOM 4: stn DW 156, 18°54′ S, 163°19′ E, 525 m, 1 dd. — Stn DW 221, 22°59′ S, 167°37′ E, 535-560 m, 2 dd.
SMIB 3: stn DW 21, 22°59′ S, 167°19′ E, 525 m, 3 dd.
Loyalty Islands. SMIB 5: stn DW 87, 22°19′ S, 168°41′ E, 370 m, 1 lv, 1 dd. — Stn DW 91, 22°18′ S, 168°41′ E, 340 m, 1 lv.

DISTRIBUTION. — Northern, southeastern and southern New Caledonia, and Loyalty Islands, 340-775 m (recorded alive).

DESCRIPTION. — *Shell* up to 13 mm in length at maturity, spinose, lightly built. Spire high with 1.5 protoconch whorls and up to 5 convex, weakly shouldered, spinose teleoconch whorls. *Protoconch* whorls rounded, smooth, weakly elongate; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of spinose varices. First whorl with 8 varices, second with 8 or 9 varices, third to last whorls with 8 varices. Varices of last whorl with 3 long, open, blunt spines. Shoulder spine longest, abapical spines shortest. Other whorls with rather long shoulder spine. Other axial sculpture consisting of numerous growth striae. Spiral sculpture consisting of low cords: 2 from first to fourth whorl, 3 on last whorl. No spiral sculpture on shoulder. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, weakly adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth. Siphonal canal long, narrow, straight, narrowly open, smooth. White. Rachidian *radular tooth* with medium sized cusps and denticles, lateral teeth sickle shaped. The illustrated radula (Fig. 24) lacks one of the lateral cusps, and is probably abnormal.

REMARKS. — *Leptotrophon charcoti* has a wide geographical distribution, and is sympatric with *L. spinacutus*, *L. bernadettae*, and *Couchatalos tirardi* off southern New Caledonia.

ETYMOLOGY. — Named after R.V. *"Jean-Charcot"*.

Leptotrophon surprisensis sp. nov.

Figs 22, 33, 56-59, 110-111

TYPE MATERIAL. — Holotype MNHN. Paratypes: 33 MNHN, 2 AMS C301332, 2 NMNZ M262673, 2 NMP L1160/T1195, 2 USNM 860396, 3 RH.

Source : MNHN, Paris

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 156, 18°54′ S, 163°19′ E, 525 m.

MATERIAL EXAMINED. — **Chesterfield Islands**, MUSORSTOM 5: stn 299, 22°48′ S, 159°24′ E, 360-390 m, 1 lv. — Stn DC 361, 19°53′ S, 158°38′ E, 400 m, 2 dd.
New Caledonia, LAGON: stn 444, 18°15′ S, 162°59′ E, 300-350 m, 1 lv, 1 dd. — Stn 1152, 18°58′ S, 163°24′ E, 335 m, 4 dd.
BIOCAL: stn DW 08, 20°34′ S, 166°54′ E, 435 m, 2 dd. — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 4 dd.
MUSORSTOM 4: stn DW 156, 18°54′ S, 163°19′ E, 525 m, 1 lv (holotype), 2 dd (paratypes). — Stn DW 162, 18°35′ S, 163°10′ E, 525 m, 2 lv, 2 dd. — Stn DW 181, 18°57′ S, 163°22′ E, 350 m, 8 lv, 8 dd (paratypes: 12 MNHN, 2 AMS, 2 NMNZ). — Stn DW 184, 19°04′ S, 163°27′ E, 260 m, 12 lv & dd (paratypes: 8 MNHN, 2 NMP, 2 USNM). — Stn DW 197, 18°51′ S, 163°21′ E, 550 m, 14 lv & dd (paratypes: 11 MNHN, 3 RH).

DISTRIBUTION. — Chesterfield Reefs, northern and southern New Caledonia, and Loyalty Islands, 260-610 m. Bathymetrical range for live-taken material 260-550 m.

DESCRIPTION. — *Shell* up to 15 mm in length at maturity. Spire high, with 1.5 protoconch whorls and up to 5 broad, shouldered, teleoconch whorls. *Protoconch* whorls smooth, glossy; terminal varix delicate. *Teleoconch* suture weakly appressed. Axial sculpture consisting of strong, rounded varices. First whorl with 8 varices, second to fourth whorls with 7 varices, last whorl with 6 varices bearing 2 short, acute, open spines, occasionally very weak. Shoulder spine longest. Other whorls with one more or less sharp shoulder spine. Other axial sculpture consisting of numerous growth striae. Spiral sculpture consisting of low, broad cords: 1 on first to fourth whorl, last whorl with 2 cords. No spiral sculpture on shoulder. Aperture ovate. Columellar lip flaring, smooth, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth, occasionally with 2 or 3 abapical elongate nodes within. Siphonal canal medium sized, narrow, straight, narrowly open, smooth. Transluscent white or light brown with small orange blotches on the varices. Rachidian *radular tooth* with medium sized cusps and denticles, lateral teeth sickle shaped.

REMARKS. — *Leptotrophon surprisensis* is one of the largest, most common and variable *Leptotrophon* species from the New Caledonian area. It is sympatric in the North with *L. lineorugosus*, *L. marshalli*, and *L. protocarinatus*, in the South with *L. caroae*, and in the Loyalty Islands with *L. caledonicus*.

ETYMOLOGY. — From Surprise Atoll, one of the localities.

Leptotrophon virginiae sp. nov.

Figs 60, 112

TYPE MATERIAL. — Holotype lv and 2 paratypes dd MNHN.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 164, 18°33′ S, 163°13′ E, 255 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality, northern New Caledonia. Recorded alive in 255 m.

DESCRIPTION. — *Shell* up to 8.2 mm, weakly spinose, lightly built. Spire high with 1.5 protoconch whorls and up to 4.5 elongate, weakly convex whorls. *Protoconch* whorls smooth, weakly subcarinate, with a single spiral keel; terminal varix low, delicate. *Teleoconch* suture weakly impressed. Axial sculpture consisting of weakly spinose, low varices. First whorl with 9 varices, second with 6 or 7 varices, third and fourth whorls with 6 varices. Last whorl with 6 or 7 very short, approximately equal-sized, open spinelets. Other axial sculpture of numerous axial growth striae. Spiral sculpture consisting of equal-sized, somewhat squamous cords: 2 on first whorl, 2 or 3 on second whorl of which 1 on shoulder, 4 on third whorl, of which 2 on shoulder, 8 or 9 on last whorl, of which 2 on shoulder. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect.

Source : MNHN, Paris

smooth. Siphonal canal short, narrow, narrowly open, with 2 spiral cords. Transluscent white; one juvenile (paratype) with dark brown blotches at base of siphonal canal. *Radula* unknown.

REMARKS. — *Leptotrophon virginiae* is sympatric with *L. caledonicus* and *L. minispinosus.*

ETYMOLOGY. — Named after Virginie HEROS (MNHN), who sorted much of the material here studied.

Leptotrophon marshalli sp. nov.

Figs 61, 113-114

TYPE MATERIAL. Holotype and 2 paratypes MNHN.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 196, 18°55′ S, 163°24′ E, 450 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 162, 18°35′ S, 163°10′ E, 525 m, 1 dd (paratype). — Stn DW 196, 18°55′ S, 163°24′ E, 450 m, 2 lv (holotype and paratype).

DISTRIBUTION. — Only known from the type locality, northern New Caledonia, in 450-525 m; recorded alive in 450 m.

DESCRIPTION. — *Shell* up to 9 mm in length at maturity, elongate, lightly built. Spire high with 1.5 protoconch whorls and up to 5 elongate, weakly shouldered teleoconch whorls. *Protoconch* whorls rounded, smooth, glossy; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of spineless, rounded varice. First whorl with 8 or 9 varices, second with 7 or 8 varices, third with 7 varices, fourth with 7 or 8 varices, last whorl with 6 varices. Other axial sculpture of numerous growth striae. Spiral sculpture consisting of numerous microscopic threads over whole shell. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth, with small node within abapically. Siphonal canal medium sized, narrow, straight, narrowly open, with microscopic spiral striae. White. *Radula* unknown.

REMARKS. — *Leptotrophon marshalli* occurs in a restricted geographical area to the north of New Caledonia where it is sympatric with *L. surprisensis.*

ETYMOLOGY. — Named after Bruce MARSHALL (NMNZ), who as visiting curator to MNHN in 1989, sorted much of the present material.

Leptotrophon protocarinatus sp. nov.

Figs 21, 34, 62, 106-107

TYPE MATERIAL. — Holotype MNHN. Paratypes: 5 MNHN, 1 NMNZ M262674, 1 RH.

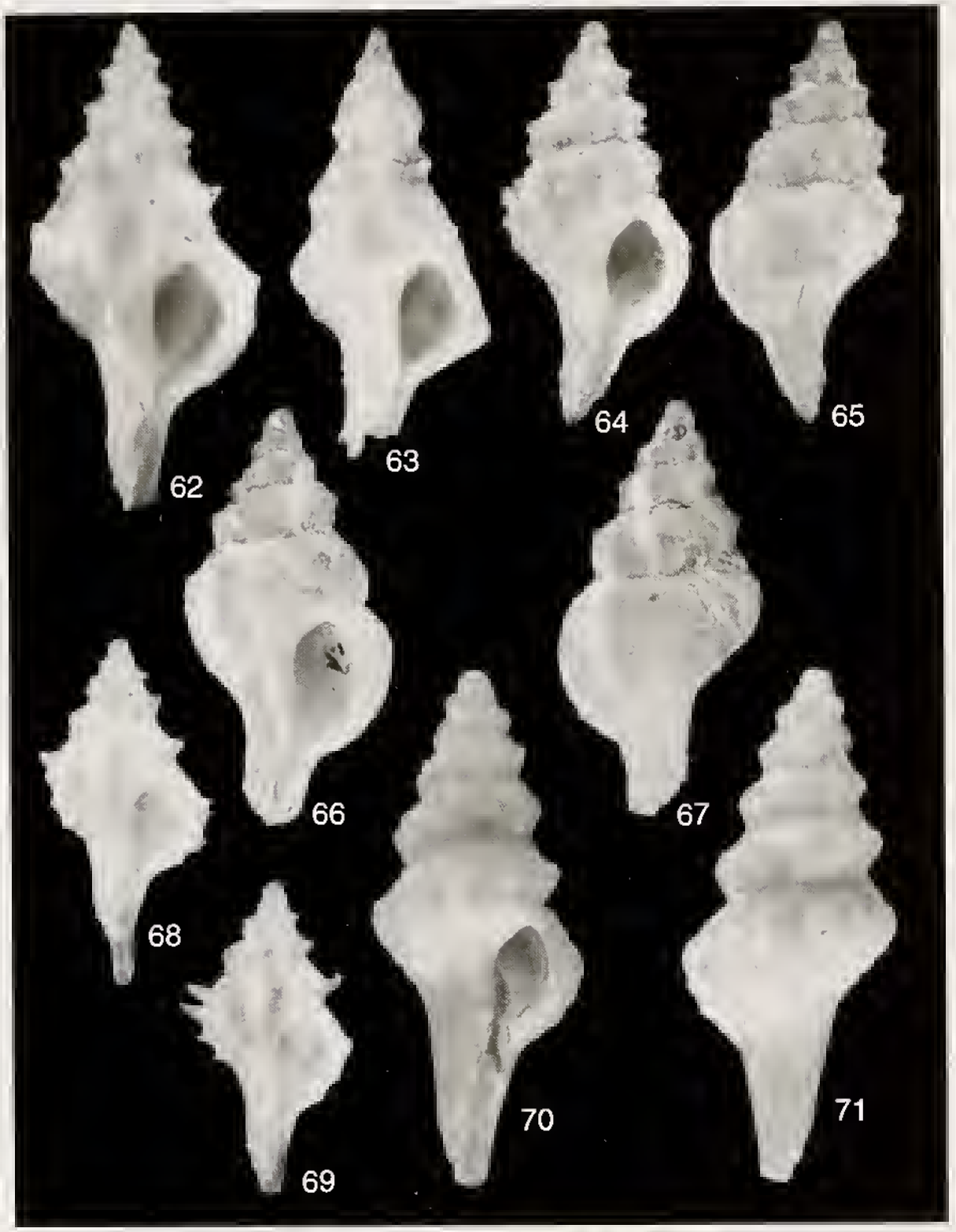
TYPE LOCALITY. — New Caledonia, LAGON, stn 444, 18°15′ S, 162°59′ E, 300-350 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality, northern New Caledonia, in 300-350 m, recorded alive.

DESCRIPTION. — *Shell* up to 11 mm in length at maturity, spinose, delicate. Spire high with 1.5 protoconch whorls and up to 5 broad, weakly shouldered teleoconch whorls. *Protoconch* whorls strongly subcarinate with a single spiral keel, otherwise smooth; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of weakly spinose varices. First whorl with 9 varices, second with 7 or 8 varices, third and fourth with 7 varices, last whorl with 6

Source : MNHN, Paris



FIGS 62-71. — Genus *Leptotrophon*. — **62**, *Leptotrophon protocarinatus* sp. nov., holotype, 10.8 mm. — **63**, *L. inaequalis* sp. nov., holotype, 12.9 mm. — **64-65**, *L. musorstomae* sp. nov., holotype, 9.9 mm. — **66-67**, *L. richeri* sp. nov., holotype, 10 mm. — **68-69**, *L. coriolis* sp. nov. — 68, holotype, 8.2 mm. — 69, paratype MNHN, MUSORSTOM 5: stn 362, 7.5 mm. — **70-71**, *L. coralensis* sp. nov., holotype, 9.5 mm.

Source : MNHN, Paris

varices bearing 4, or occasionally 5 small, short spines. Shoulder spine longest. Other whorls with 1 or 2 small spines. Spiral sculpture consisting of primary, weak cords; 2 from first to fourth whorl, 4 or rarely 5 on last whorl. Occasionally with weak, secondary cords on last whorl. No spiral sculpture on shoulder. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth. Siphonal canal medium sized, narrow, straight, narrowly open, smooth. Transluscent white, rarely with very pale brown blotch between axial varices, on shoulder of teleoconch whorl. Rachidian *radular tooth* with medium sized cusps and denticles, lateral teeth sickle shaped.

REMARKS. — *Leptotrophon protocarinatus* is remarkable for its keeled protoconch. It lives in a very restricted geographical area, sympatrically with *L. surprisensis*.

ETYMOLOGY. — Named for the keeled protoconch.

Leptotrophon inaequalis sp. nov.

Figs 63, 115

TYPE MATERIAL. — Holotype and paratype MNHN.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 38, 23°00′ S, 167°15′ E, 360 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 38, 23°00′ S, 167°15′ E, 360 m, 1 dd (holotype).
SMIB 2: stn DW 03, 22°56′ S, 167°15′ E, 412-428 m, 1 dd (paratype).

DISTRIBUTION. — Southern New Caledonia, in 360-428 m; not recorded alive.

DESCRIPTION. — *Shell* up to 12.9 mm in length at maturity, heavy. Spire high with 1.5 protoconch whorls and up to 5 strongly shouldered teleoconch whorls. *Protoconch* whorls strongly subcarinate with a single spiral keel, otherwise smooth; terminal varix unknown (eroded). *Teleoconch* suture impressed. Axial sculpture consisting of strongly shouldered, almost spineless varices. First and second whorls with 7 varices, third and fourth with 6 or 7 varices, last whorl with 5 varices. Shoulder spine short, broad, heavy. Other axial sculpture of numerous growth striae. Spiral sculpture consisting of a shallow, broad cord that interconnect the shoulder spines. Other spiral sculpture of numerous, fine striae. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth, with small abapical node within. Siphonal canal short, narrow, straight, narrowly open, smooth. White. *Radula* unknown.

REMARKS. — *Leptotrophon inaequalis* is a very strange form with strongly shouldered teleoconch whorls. It lives with *L. acerapex*.

ETYMOLOGY. — *Inaequalis* (Latin) = unequal.

Leptotrophon coriolis sp. nov.

Figs 17-18, 68-69, 116-117

TYPE MATERIAL. — Holotype MNHN. Paratypes: 3 MNHN, 1 NMNZ M262675, 1 NMP L1161/T1196, 1 RH.

TYPE LOCALITY. — Coral Sea, MUSORSTOM 5, stn DC 362, 19°53′ S, 158°40′ E, 410 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DC 345, 19°40′ S, 158°32′ E, 305-310 m, 1 lv. — Stn DC 361, 19°53′ S, 158°38′ E, 400 m, 1 dd. — Stn DC 362, 19°53′ S, 158°40′ E, 410 m, 1 lv (holotype), 6 lv & dd (paratypes: 3 MNHN, 1 NMNZ, 1 NMP, 1 RH. — Stn DC 372, 19°53′ S, 158°39′ E, 400 m, 1 dd. — Stn DC 379, 19°53′ S, 158°40′ E, 370-400 m, 1 lv.

DISTRIBUTION. — Chesterfield Reefs, 305-410 m; recorded alive.

Source : MNHN, Paris

DESCRIPTION. — *Shell* up to 8.2 mm in length, spinose, lightly built. Spire high with 1.5 protoconch whorls and up to 4 convex, weakly shouldered teleoconch whorls. *Protoconch* whorls rounded, smooth, glossy. Terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of spinose varices. First and second whorls with 8 varices, third with 7 or 8 varices, last whorl with 6 varices bearing 3 short, sharp spines. Shoulder spine longest. Other whorls with a single shoulder spine. Other axial sculpture of numerous growth striae. Spiral sculpture consisting of weak cords, almost obsolete between varices: 1 or 2 on first whorl, 2 on second and third whorl, 3 on last whorl. Aperture ovate. Columellar lip flaring, usually with 1 or 2 denticles abapically, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth, with one small knob abapically and 3 or 4 lirae within. Siphonal canal medium sized, narrow, straight, narrowly open, smooth. Teleoconch translucent white with tip of shoulder spines of last teleoconch whorl occasionally orange coloured. Protoconch very pale brown. Rachidian *radular tooth* with medium sized cusps and denticles, lateral teeth sickle shaped.

REMARKS. — No other species of *Leptotrophon* or *Conchatalos* have been found to be sympatric with *L. coriolis*.

ETYMOLOGY. — Named after R.V. "*Coriolis*".

Leptotrophon musorstomae sp. nov.

Figs 64-65, 119

TYPE MATERIAL. — Holotype MNHN.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DC 168, 18°48′ S, 163°11′ E, 720 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality, northern New Caledonia, in 720 m; not recorded alive.

DESCRIPTION. — *Shell* up to 9.9 mm in length, stout. Spire high with 1.75 protoconch whorls and up to 4 convex, weakly shouldered teleoconch whorls. *Protoconch* bulbous, smooth; terminal varix unknown (eroded). *Teleoconch* suture impressed. Axial sculpture consisting of 9 rounded varices from first to last whorls. Spiral sculpture consisting of weak, rounded cords: 2 on first and second whorls, 3 on third whorl, 5 on last whorl. Spiral cords ending as rounded knobs on the varices imparting a tuberculate appearance on the shell. Shoulder with 1 or 2 weak secondary cords. Aperture ovate. Inner and outer lip slightly broken. Outer lip with 2 abapical elongate knobs within. Anal notch shallow, broad. Siphonal canal medium sized, straight, open, smooth. White. *Radula* unknown.

REMARKS. — No other similar species have been found to be sympatric with *L. musorstomae*.

ETYMOLOGY. — Named after the cruise name MUSORSTOM.

Leptotrophon richeri sp. nov.

Figs 66-67, 118

TYPE MATERIAL. — Holotype and 2 paratypes MNHN.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 160, 18°42′ S, 163°13′ E, 668 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 160, 18°42′ S, 163°13′ E, 668 m, 1 dd (holotype). — Stn DW 161, 18°39′ S, 163°11′ E, 550 m, 2 dd (paratypes).

DISTRIBUTION. — Northern New Caledonia, in 550-668 m: not recorded alive.

Source : MNHN, Paris

DESCRIPTION. *Shell* up to 10 mm in length at maturity, stout. Spire high with 1.5 protoconch whorls and up to 5 broad, weakly shouldered whorls. *Protoconch* whorls rounded, smooth; terminal varix unknown (eroded). *Teleoconch* suture impressed. Axial sculpture consisting of low, rounded varices. First and second whorls with 8 varices, third with 8 or 9 varices, fourth with 8 varices, last whorl with 6 or 7 varices. Other axial sculpture of numerous growth striae. Spiral sculpture consisting of rounded, weak cords: 2 from first to third whorls, 6 on fourth whorl, including 2 on shoulder, 10 or 11, including 2 on shoulder on last whorl. Aperture ovate. Columellar lip smooth. Inner and outer lip of specimens partially broken. Anal notch shallow, broad. Outer lip erect, smooth. Siphonal canal short, narrow, straight, open, smooth. Whitish. *Radula* unknown.

REMARKS. — *Leptotrophon richeri* is sympatric with *L. lineorugosus*.

ETYMOLOGY. — Named after Bertrand RICHER DE FORGES, senior scientist during the MUSORSTOM 4 cruise.

Leptotrophon coralensis sp. nov.

Figs 70-71, 120-121

TYPE MATERIAL. — Holotype dd MNHN.

TYPE LOCALITY. — Lansdowne-Fairway Ridge, CORAIL 2, stn DE 14, 21°01′ S, 160°57′ E, 650-660 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality, not recorded alive.

DESCRIPTION. — *Shell* up to 9.5 mm in length at maturity, narrow, stout. Spire high with 1.5 protoconch whorls and up to 5 strongly shouldered teleoconch whorls. *Protoconch* smooth, whorls rounded, glossy; terminal varix low, delicate. *Teleoconch* suture weakly appressed. Axial sculpture consisting of low, rounded varices. First whorl with 9 varices, second with 8 varices, third and fourth with 9 varices, last whorl with 7 varices. Varices bearing a short, open, shoulder spine. Spiral sculpture consisting of one low, carinal cord, almost obsolete between varices. Last whorl with 3 or 4 very weak, secondary cords abapically. Aperture ovate, small. Columellar lip partially broken, with one small denticle abapically. Anal notch shallow, broad. Outer lip erect, smooth, abapically with 3 small elongate nodes within. Siphonal canal medium sized, narrow, straight, open, smooth. Transluscent white. *Radula* unknown.

REMARKS. — Known only from one specimen, this species differs from other known *Leptotrophon* species (Table 2). It is not sympatric with any other similar species.

ETYMOLOGY. — Named after the Coral Sea.

Leptotrophon metivieri sp. nov.

Figs 72-73, 122

TYPE MATERIAL. — Holotype dd MNHN. Paratypes dd: 4 MNHN, 1 NMP L1162/T1197, 1 NMNZ M262676, 1 RH.

TYPE LOCALITY. — New Caledonia. CHALCAL 2, stn DW 76, 23°41′ S, 167°45′ E, 470 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality, not recorded alive.

DESCRIPTION. — *Shell* up to 7.8 mm in length, spinose, lightly built. Spire high, acute with 1.75 protoconch whorls and up to 4 broad, weakly spinose teleoconch whorls. *Protoconch* elongate, acute, whorls smooth, glossy; terminal

Source : MNHN, Paris

TABLE 2. — Characters of *Leptotrophon* described in this paper.

Species	Character/character state										
	1	2	3	4	5	6	7	8	9	10	11
Leptotrophon acerapex	acuminate		spinose	long	straight	strong	1	0	3	no	12.5
L. bernadettae	acuminate		spinose	long	bent	strong	2	2-3	5	no	12
L. biocalae	carinate		spinose	long	straight	weak	1	0-1	3	yes	8
L. caledonicus	rounded			short	straight	weak	1	2	5	yes	12.2
L. caroae	rounded	narrow	spinose	long	straight	weak	1	1	5	no	9.3
L. charcoti	rounded		spinose	long	straight	weak	2	0	3	no	13
L. coralensis	rounded	narrow	spinose	long	straight	strong	1	0	4-5	no	9.5
L. coriolis	rounded		spinose	long	straight	weak	1-2	0	3	no	8.2
L. inaequalis	carinate	narrow	spinose	short	straight	strong	1	0	1	no	12.9
L. levii	rounded	narrow	spinose	long	bent	weak	2	1	4-5	no	7.9
L. lineorugosus	rounded			long	straight	weak	3	2-4	17-19	yes	10.9
L. marshalli	rounded	narrow		long	straight	weak	1	0	0	yes	9
L. metivieri	acuminate		spinose	short	straight	weak	2	1	6-7	yes	7.8
L. minispinosus	rounded	narrow	spinose	long	straight	weak	1	1-3	2-4	no	11.2
L. musorstomae	rounded		spinose	long	straight	weak	1-2	1-2	5	no	9.9
L. protocarinatus	carinate		spinose	long	straight	weak	2	0	4-5	no	11
L. richeri	rounded			short	straight	weak	2	2	10-11	no	10
L. rigidus	rounded		spinose	long	straight	strong	2	2-3	5-6	no	13.5
L. spinacutus	rounded		spinose	long	straight	weak	1	1	5-6	yes	12
L. surprisensis	rounded		spinose	long	straight	weak	1	0	2	no	15
L. turritellatus	carinate	narrow	spinose	long	straight	strong	1	0	2	yes	11.2
L. virginiae	carinate	narrow	spinose	short	straight	weak	2	2	6	yes	8.2

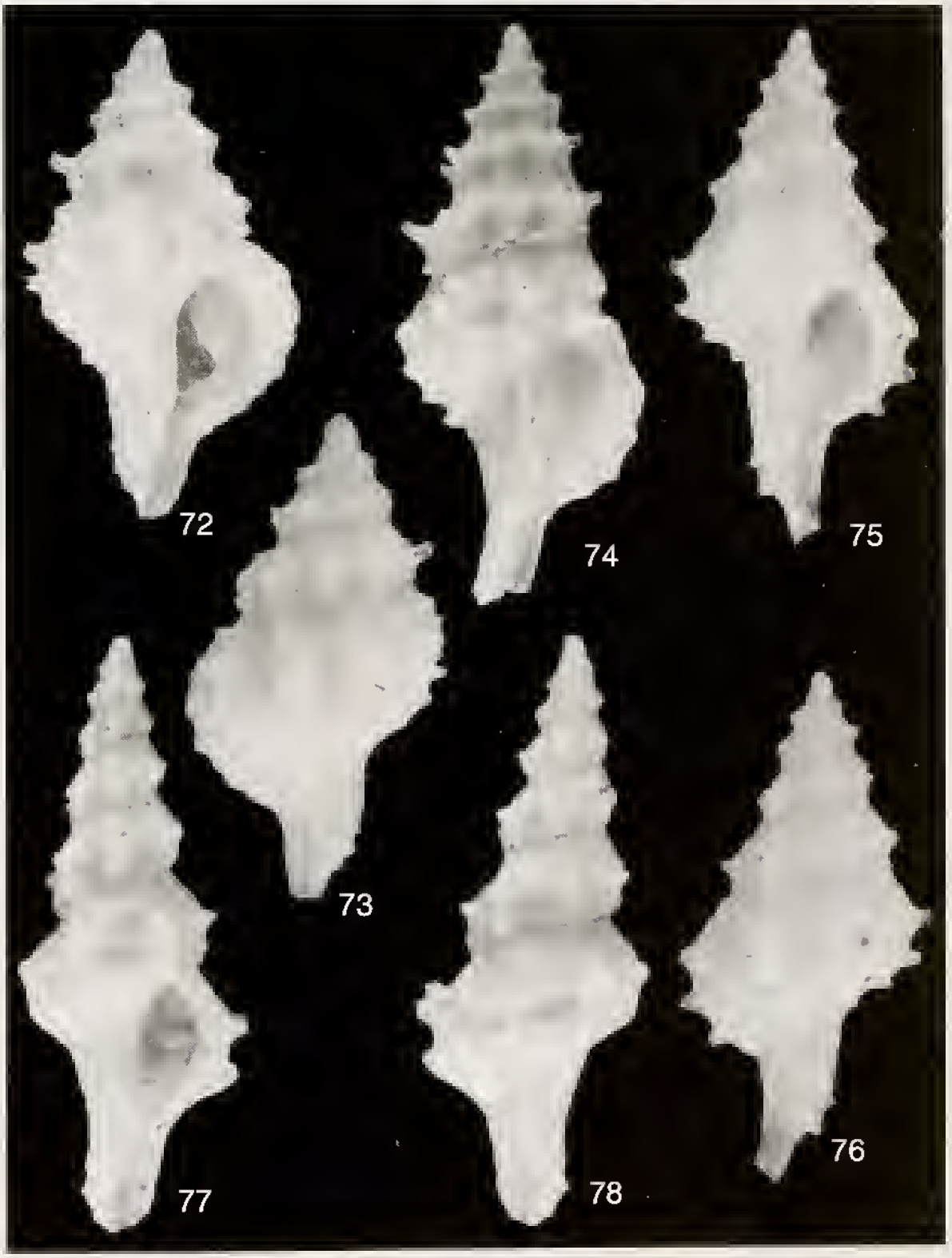
(1) Form of protoconch; (2) Form of shell; (3) Sculpture; (4) Length of siphonal canal; (5) Form of siphonal canal; (6) Shell shoulder; (7) Number of spiral cords on first teleoconch whorl; (8) Number of spiral cords on shoulder of last teleoconch whorl; (9) Number of cords (not lirae) on last teleoconch whorl; (10) Spiral sculpture on siphonal canal (present/absent); (11) Maximum shell length (mm).

varix obsolete. *Teleoconch* suture impressed. Axial sculpture consisting of rounded, somewhat spinose varices. First whorls with 9 varices, second and third with 8 varices, last whorl with 7 varices bearing 6 very short, acute spines, occasionally reduced to small knobs. Spiral sculpture consisting of low, rounded cords: 2 on first and second whorls, 3 or 4 on third and 6, or occasionally 7 on last whorl. Third and last whorls with one cord on shoulder. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth, with narrow, weak lirae within, and one small node abapically. Siphonal canal short, narrow, straight, open, with shallow spiral cords. Translucent white. *Radula* unknown.

REMARKS. — All known specimens have only 4 teleoconch whorls and are probably immature. It is sympatric with *Conchatalos canalibrevis*.

ETYMOLOGY. — Named after Bernard MÉTIVIER (MNHN), scientist on board of the R.V. "*Coriolis*" during the CHALCAL 2 cruise.

Source : MNHN, Paris



FIGS 72-78. — Genus *Leptotrophon*.-**72-73**, *Leptotrophon nietivieri* sp. nov., holotype, 7.8 mm. — **74**, *L. minispinosus* sp. nov., holotype, 11.1 mm. — **75-76**, *L. biocalae* sp. nov., holotype, 8 mm. — **77-78**, *L. turritellatus* sp. nov., holotype, 11.5 mm.

Source : MNHN, Paris

Leptotrophon biocalae sp. nov.

Figs 75-76, 124

TYPE MATERIAL. — Holotype and 3 paratypes dd MNHN.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 64, 24°48′ S, 168°09′ E, 250 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTIBUTION. — Only known from the type locality, not recorded alive.

DESCRIPTION. — *Shell* up to 8 mm in length at maturity, spinose, lightly built. Spire high with 1.5 protoconch whorls and up to 5 convex, weakly shouldered teleoconch whorls. *Protoconch* small, weakly carinate with a single spiral keel, otherwise smooth; terminal varix low, delicate. *Teleoconch* suture weakly impressed. Axial sculpture consisting of low spinose varices. First and second whorls with 7 varices, third and fourth whorls with 6 varices, last whorl with 5 varices bearing 3 short, narrow, open spines. Other whorls with a short, open shoulder spine. Other axial sculpture consisting of numerous, fine growth striae. Spiral sculpture consisting of weak cords: 1 on first whorl, 2 on second to fourth whorls, last whorl with 3 or 4 cords. Occasionally one low, weak spiral cord on shoulder of last whorl. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth. Siphonal canal medium sized, narrow, weakly abaperturally bent, narrowly open, with 2 or 3 shallow, low spiral cords. White. *Radula* unknown.

REMARKS. — *Leptotrophon levii* was dredged in the vicinity, though at greater depth (505-515 m). No other species of *Leptotrophon* or *Conchatalos* is known to be sympatric.

ETYMOLOGY. — Named after the cruise name BIOCAL.

Leptotrophon turritellatus sp. nov.

Figs 77-78, 125

TYPE MATERIAL. — Holotype dd MNHN.

TYPE LOCALITY. — New Caledonia, SMIB 5, stn DW 102, 23°20′ S, 168°05′ E, 305 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality, not recorded alive.

DESCRIPTION. — *Shell* 11.2 mm in length. Spinose, narrow, lightly built. Spire high, acute, consisting of 1.5 protoconch whorls and 6 narrow, shouldered teleoconch whorls. *Protoconch* carinate with a single spiral keel, otherwise smooth; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of low varices. First and second whorls with 7 varices, third to fifth whorls with 6 varices, last whorl with 5 varices with 2 small, open spines. Other axial sculpture of numerous growth striae. Spiral sculpture consisting of low, rounded cords: 1 on first and second whorls, 2 from second to last whorl. Other spiral sculpture of numerous, fine striae. No spiral sculpture on shoulder except fine striae. Aperture ovate. Columellar lip flaring (rim somewhat broken), smooth, rim partially erect, adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth. Siphonal canal medium-sized, broad, straight, narrowly open, with 4 weak, low spiral cords. Glossy white. *Radula* unknown.

REMARKS. — *Leptotrophon turritellatus* is a strange form, narrow with a comparatively broad siphonal canal. Although known by only a single specimen, *L. turritellatus* is distinct from the other species of *Leptotrophon*.

ETYMOLOGY. — Named for its elongate form, as in the gastropod genus *Turritella*.

Source : MNHN, Paris

Leptotrophon minispinosus sp. nov.

Figs 74, 123

TYPE MATERIAL. – Holotype MNHN. Paratypes: 4 MNHN, 1 NMNZ M262677, 1 RII.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 184, 19°04′ S, 163°27′ E, 260 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 164, 18°33′ S, 163°13′ E, 255 m, 1 lv (paratype NMNZ). — Stn DW 184, 19°04′ S, 163°27′ E, 260 m, 1 lv (holotype), 5 lv & dd (paratypes: 4 MNHN, 1 RH).

DISTIBUTION. — Northern New Caledonia, in 255-260 m; recorded alive.

DESCRIPTION. — *Shell* up to 11.2 mm in length at maturity, weakly spinose. Spire high with 1.5 protoconch whorls and up to 6 narrow, weakly shouldered, spinose teleoconch whorls. *Protoconch* whorls rounded, smooth; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of low varices. First whorl with 9 varices, second with 7 or 8 varices, third to fifth whorls with 7 varices, last whorl with 6 varices bearing 1-3 short, acute, open spines. Spiral sculpture consisting of weak cords: 1 from first to third whorls, 1 or 2 on fourth whorl, 2 on fifth whorl, 3 or 4 on last whorl. Penultimate whorl with 1 cord on shoulder, last teleoconch whorl with 1 or 2 primary cords and 1 weak, secondary cord on shoulder. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, adherent at adapical extremity. Anal notch smooth, broad. Outer lip erect, smooth, with 2 or 3 weak denticles inside adapically. Siphonal canal medium sized, narrow, straight, narrowly open, smooth. White or beige, with some irregularly placed light brown coloured blotches. *Radula* unknown.

REMARKS. — *Leptotrophon minispinosus* lives sympatrically with *L. caledonicus*, and *L. virginiae*.

ETYMOLOGY. — From *minimus* (Latin) = very small, and *spinosus* (Latin) = spinose.

Genus *CONCHATALOS* gen. nov.

Type species: *Trophon lacrima* Houart, 1991: Recent, Southern New Caledonia.

DIAGNOSIS. — *Shell* up to 13 mm in length, last teleoconch whorl globose, with 5-9 axial ribs. Aperture large, roundly-ovate, with flaring columellar lip. Siphonal canal short, straight or occasionally weakly bent, spineless, open. Rachidian *radular tooth* with medium-sized to long, triangular central cusp; lateral denticles and marginal cusps small or reduced to folds, lateral cusps small and broadly triangular. Lateral teeth sickle-shaped.

REMARKS. — The species of *Conchatalos* are different from these of *Leptotrophon* in being spineless with a more globose last teleoconch whorl, a broader aperture and a shorter siphonal canal. The morphology of the radula is also distinctive (Figs 25-27). Specific characters are compared in Table 3.

ETYMOLOGY. — From *Conchè* (Greek): shell and *atalos* (Greek): delicate.

Source : MNHN, Paris

TABLE 3. — Characters of species of *Conchatalos* described in this paper.

Species	Character/character state								
	1	2	3	4	5	6	7	8	9
Conchatalos canalibrevis	rounded	short	bent	weak	2	1	4-6	no	5.9
C. lacrima	conical	short	bent	weak	1	0	0	no	12
C. tirardi	rounded	short	bent	weak	1	2-3	10-14	yes	13
C. vaubani	rounded	short	straight	weak	2	2	8-9	yes	11.9

(1) Form of protoconch; (2) Length of siphonal canal; (3) Form of siphonal canal; (4) Shell shoulder; (5) Number of spiral cords on first teleoconch whorl; (6) Number of spiral cords on shoulder of last teleoconch whorl; (7) Number of cords (not lirae) on last teleoconch whorl; (8) Spiral sculpture on the siphonal canal (present/absent); (9) Maximum shell length (mm).

Conchatalos lacrima (Houart, 1991)

Figs 25, 35, 80, 128-129

Trophon lacrima Houart, 1991: 52, figs 31-32, 40, 55-56.

TYPE MATERIAL. — Holotype MNHN. Paratypes: 38 MNHN, 2 AMS C164823, 2 RH, 2 NMP T280/K7294, 2 NMNZ MF57498, 1 NSMT Mo-69563, 2 USNM 859447.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 44, 22°47′ S, 167°14′ E, 440-450 m.

MATERIAL EXAMINED. — **New Caledonia.** BIOCAL: stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 50 dd & lv (holotype and paratypes).
SMIB 2: stn DW 02, 22°52′ S, 167°13′ E, 415 m, 1 lv (paratype).

DISTRIBUTION. — Southern New Caledonia, 415-450 m: recorded alive.

DESCRIPTION. — *Shell* up to 12 mm in length at maturity. Spire high and acute, with 1.5 protoconch whorls and up to 5 weakly shouldered teleoconch whorls. *Protoconch* conical, whorls smooth, ending with a very weakly erect terminal varix. *Teleoconch* suture lightly appressed. First and second whorls with 9 or 10 low axial ridges, third and fourth with 8 or 9 ridges, last whorl with 5-7 axial ridges. From fourth whorl ridges becoming irregularly spaced, generally leaving a broad gap between penultimate and last varix, some varices forming a sharp, arched lamella on last whorl. Other axial sculpture consisting of growth striae. Numerous fine spiral lirae covering whole surface of shell. Aperture broad, large. Columellar lip flaring, smooth, rim partially erect, adherent adapically on a small portion. Anal notch shallow. Outer lip thin and smooth. Siphonal canal short, narrowly open, smooth, bent adaperturally. Whitish with very light brownish blotches. Rachidian *radular tooth* with long central cusp, 2 smaller lateral cusps and 1 or 2 marginal folds. Lateral teeth sickle shaped.

REMARKS. — As already stated (HOUART, 1991: 53), *Conchatalos tirardi* is related to *C. lacrima* but differs in having a larger shell with more rounded protoconch, fewer, more strongly developed spiral cords, and more numerous axial ribs on the last teleoconch whorl. It is sympatric with *Leptotrophon acerapex* and *L. caroae*.

Conchatalos tirardi (Houart, 1991)

Figs 26, 81-82, 126-127

Trophon tirardi Houart, 1991: 53, figs 33-34, 41-42, 57-58.

TYPE MATERIAL. — Holotype MNHN. Paratypes: 61 MNHN, 2 AMS C164824, 2 RH, 2 NMP T363/K7295, 2 NMNZ MF57499, 1 NSMT Mo-69564, 2 USNM 859448.

Source : MNHN, Paris

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 51, 23°05′ S, 167°45′ E, 680-700 m.

MATERIAL EXAMINED. — **New Caledonia**, BIOCAL: stn DW 33, 23°10′ S, 167°10′ E, 675-680 m, 11 lv (paratypes). — Stn DW 36, 23°09′ S, 167°11′ E, 650-680 m, 1 lv (paratype). — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 54 lv & dd (holotype and paratypes: 42 MNHN, 2 AMS, 2 RH, 2 NMP, 2 NMNZ, 1 NSMT, 2 USNM).
MUSORSTOM 4: stn DW 220, 22°58′ S, 167°38′ E, 505-550 m, 3 lv (paratypes). — Stn DW 221, 22°59′ S, 167°37′ E, 535-560 m, 2 lv (paratypes). — Stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 2 lv (paratypes).

DISTRIBUTION. — Southern New Caledonia, 410-700 m; recorded alive.

DESCRIPTION. *Shell* up to 13 mm in length at maturity. Spire high, with 1.5 protoconch whorls and up to 5 broadly convex, weakly shouldered teleoconch whorls. *Protoconch* whorls rounded, smooth, ending with a shallow terminal varix. *Teleoconch* suture impressed. Axial sculpture of first to third whorls of 8-10 low, sharp ribs, fourth whorl with 9 or 10 ribs and last whorl with 8 or 9 ribs. Some ribs produce erect, irregularly placed, arched lamellae. Other axial sculpture consisting of numerous, frilled, lirae. Spiral sculpture of 10-14 nodulose, shallow or strongly developed cords on last whorl. Carinal cord sometimes stronger, with an occasional small knob or spine where it cross axial ribs. Aperture large and broad. Columellar lip flaring, rim erect. Anal notch shallow, broad. Outer lip thin, smooth, occasionally with small abapical denticle within. Siphonal canal short, narrowly open with 5 or 6 spiral cords on its base, tip smooth. Uniformly whitish to very light brown. Rachidian *radular tooth* with a long central cusp, occasionally small lateral folds, 2 small lateral cusps and 1 or 2 marginal cusps or folds. Sickle shaped lateral teeth.

REMARKS. — *Conchatalos tirardi* apparently lives further south and at greater depths than the related species *C. lacrima*. It is sympatric with *Leptotrophon bernadettae* and *L. charcoti*.

Conchatalos canalibrevis sp. nov.

Figs 84-85, 132-133

TYPE MATERIAL. — Holotype and 2 paratypes lv MNHN.

TYPE LOCALITY. — New Caledonia, CHALCAL 2, stn DW 76, 23°41′ S, 167°45′ E, 470 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality, recorded alive.

DESCRIPTION. — *Shell* up to 5.9 mm in length, lightly built. Spire high with 1.5 protoconch whorls and up to 4, broad, convex teleoconch whorls. *Protoconch* whorls rounded, smooth, glossy; terminal varix low, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of rounded, high varices. First whorl with 9 or 10 varices, second with 9 varices, third and last whorl with 8 varices. Other axial sculpture consisting of numerous growth striae. Spiral sculpture consisting of very weak cords, ending as small knobs on varices: 2 on first and second whorl, 3 on third whorl, 4-6 on last whorl. Third and last whorls with one spiral cord on shoulder. Other spiral sculpture of numerous spiral striae. Aperture ovate. Columellar lip flaring, smooth, rim partially erect, weakly adherent at adapical extremity. Anal notch shallow, broad. Outer lip erect, smooth, with a small node within abapically. Siphonal canal short, narrow, abapertu-rally bent, open, smooth. Pale brown. *Radula* unknown.

REMARKS. — A very small species, also with only 4 teleoconch whorls. It is sympatric with *Leptotrophon metivieri* sp. nov.

ETYMOLOGY. — Named for the short siphonal canal.

Source : MNHN, Paris

Conchatalos vaubani sp. nov.

Figs 27, 83, 130-131

TYPE MATERIAL. — Holotype and 3 paratypes MNHN.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 222, 22°58′ S, 167°33′ E, 410-440 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 1 lv, 1 dd (holotype and paratype). — Stn DW 234, 22°15′ S, 167°08′ E, 350-365 m, 2 lv (paratypes).

DISTRIBUTION. — Southern New Caledonia, 350-440 m; recorded alive.

DESCRIPTION. — *Shell* up to 11.9 mm in length, heavy. Spire high with 1.5 protoconch whorls and up to 5 broad, weakly shouldered teleoconch whorls. *Protoconch* whorls rounded, minutely striated; terminal varix low, thin. *Teleoconch* suture impressed. Axial sculpture consisting of weakly angulate, spineless, axial ribs. First whorl with 10 ribs, second to fourth whorls with 8 ribs, last whorl with 7 ribs. Other axial sculpture of numerous, fine growth striae. Spiral sculpture consisting of narrow, weak cords: 2 on first and second whorl, 2 or 3 on third and fourth whorl, last whorl with 8 or 9 cords, including 2 on shoulder. Numerous, very weak striae over whole surface. Aperture ovate. Columellar lip flaring, smooth, except small node abapically, rim partially erect, weakly adherent at adapical extremity. Anal notch shallow, broad. Outer lip smooth, with a single abapical node within. Siphonal canal short, narrow, straight, narrowly open, with shallow spiral cords. White or light brown with small, pale orange blotches on penultimate and last whorls, on shoulder, between each pair of varices. Rachidian *radular tooth* with a broad, long, central cusp, small lateral denticles and medium-sized lateral cusps, marginal cusps reduced to some folds. Lateral teeth sickle shaped.

REMARKS. — *Conchatalos vaubani* lives sympatrically with *Leptotrophon spinacutus*, *L. acerapex*, and *L. bernadettae*.

ETYMOLOGY. — Named after the R.V. *"Vauban"*.

Genus *APIXYSTUS* Iredale, 1929

Apixystus Iredale, 1929: 185. Type species (OD): *Trophon stimuleus* Hedley, 1907. Recent, New South Wales, Australia.

REMARKS. — The shell in *Apixystus* differs from that in *Trophonopsis*, *Leptotrophon* and *Conchatalos* in being smaller, more globose, with a shorter siphonal canal and a more rounded aperture. The radula of *A. leptos* sp. nov. is distinct from those of the species of hereabove genera in having weaker, more crowded, cusps on the rachidian tooth.

Apixystas leptos sp. nov.

Figs 28-29, 86-89, 134-136

TYPE MATERIAL. — Holotype and 3 paratypes MNHN.

TYPE LOCALITY. — Coral Sea, MUSORSTOM 5, stn DW 346, 19°40′ S, 158°27′ E, 245-252 m.

MATERIAL EXAMINED. — **Australia**. Masthead Is, Capricorn Group, Queensland, 23°32′ S, 151°45′ E, 31-37 m, 1 dd (AMS C21787). — 3 km NE of N side of Gillett Bay, Swains Reef, S Barrier Reef, Queensland, 64-73 m, 2 dd (AMS C150077).

Source : MNHN, Paris

Chesterfield Islands. MUSORSTOM 5: stn DW 346, 19°40′ S, 158°27′ E, 245-252 m, 4 lv (holotype and paratypes).

DISTRIBUTION. — South Queensland, Australia to Chesterfield Reefs, in 31-252 m; recorded alive in 245-252 m (Chesterfield Reefs).

DESCRIPTION. — *Shell* up to 4.9 mm in length (AMS C150077), spinose, delicate. Spire high with 1.75 protoconch whorls and up to 4 angulate, shouldered, spinose teleoconch whorls. *Protoconch* acuminate, strongly keeled, whorls smooth, glossy; terminal varix erect, delicate, thin. *Teleoconch* suture impressed. Axial sculpture consisting of sharp, erect lamellae. First whorl with 10 or 11 lamellae, second and third whorl with 11 lamellae, last whorl with 10 or 11 lamellae. Spiral sculpture consisting of weak, rounded cords: 2 on first to third whorls, 3 or 4 on last whorl. Aperture rounded. Columellar lip flaring, smooth, partially erect, weakly adherent at adapical extremity. Anal notch obsolete. Outer apertural lip smooth, with 5 strong, elongate denticles within. Siphonal canal short to medium-sized, narrow, weakly abaxially bent, open, smooth. Translucent milky-white with traces of pale brown on last teleoconch whorl. Rachidian *radular tooth* with long central and marginal cusps, and short lateral denticles. Lateral teeth sickle shaped.

REMARKS. — *Apixystus stimuleus* (Hedley, 1907) is smaller with fewer axial lamellae on the first and second teleoconch whorls, and is less spinose, with a rounded rather than acute and keeled protoconch. There are no denticles in the inner side of the outer apertural lip as in *A. leptos* sp. nov. One specimen (AMS C21787) from the Capricorn Group and two from Swains Reefs, Queensland (AMS C150077), formerly identified as *Apixystus stimuleus* are here considered to represent *A. leptos* sp. nov.

ETYMOLOGY. — *Leptos* (Greek) = thin, delicate.

Genus *LITOZAMIA* Iredale, 1929

Litozamia Iredale, 1929: 185. Type species (OD): *Peristernia rudolphi* Brazier, 1894. Recent, southern Tasmania.

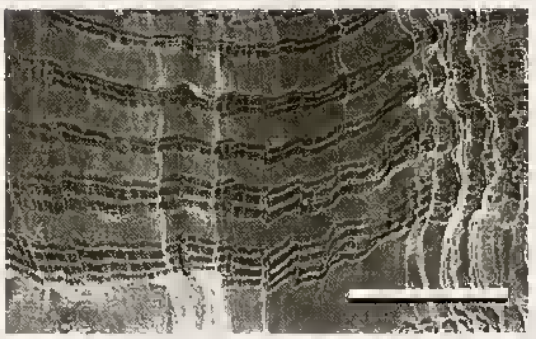


FIG. 79. — *Litozamia tropis* sp. nov., detail of shell sculpture, holotype. Scale bar: 100 µm.

Litozamia tropis sp. nov.

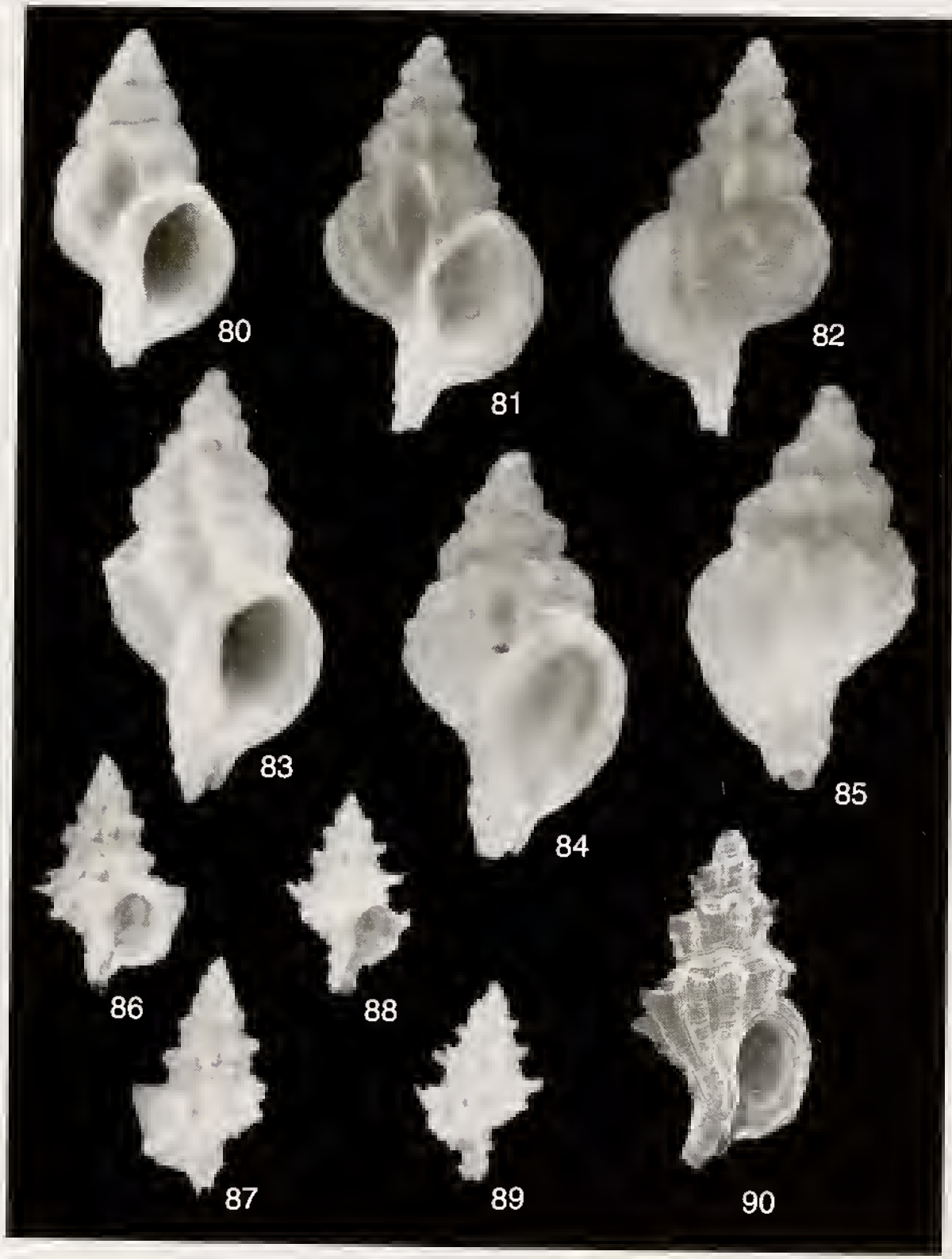
Figs 79, 90, 141-142

TYPE MATERIAL. — Holotype dd MNHN. Paratypes dd: 26 MNHN, 2 AMS C301333, 2 NMNZ M262678, 2 NMP L1163/T1198, 2 USNM 860397, 2 RH.

TYPE LOCALITY. — New Caledonia, LAGON, stn 830, 20°49′ S, 165°19′ E, 105-110 m.

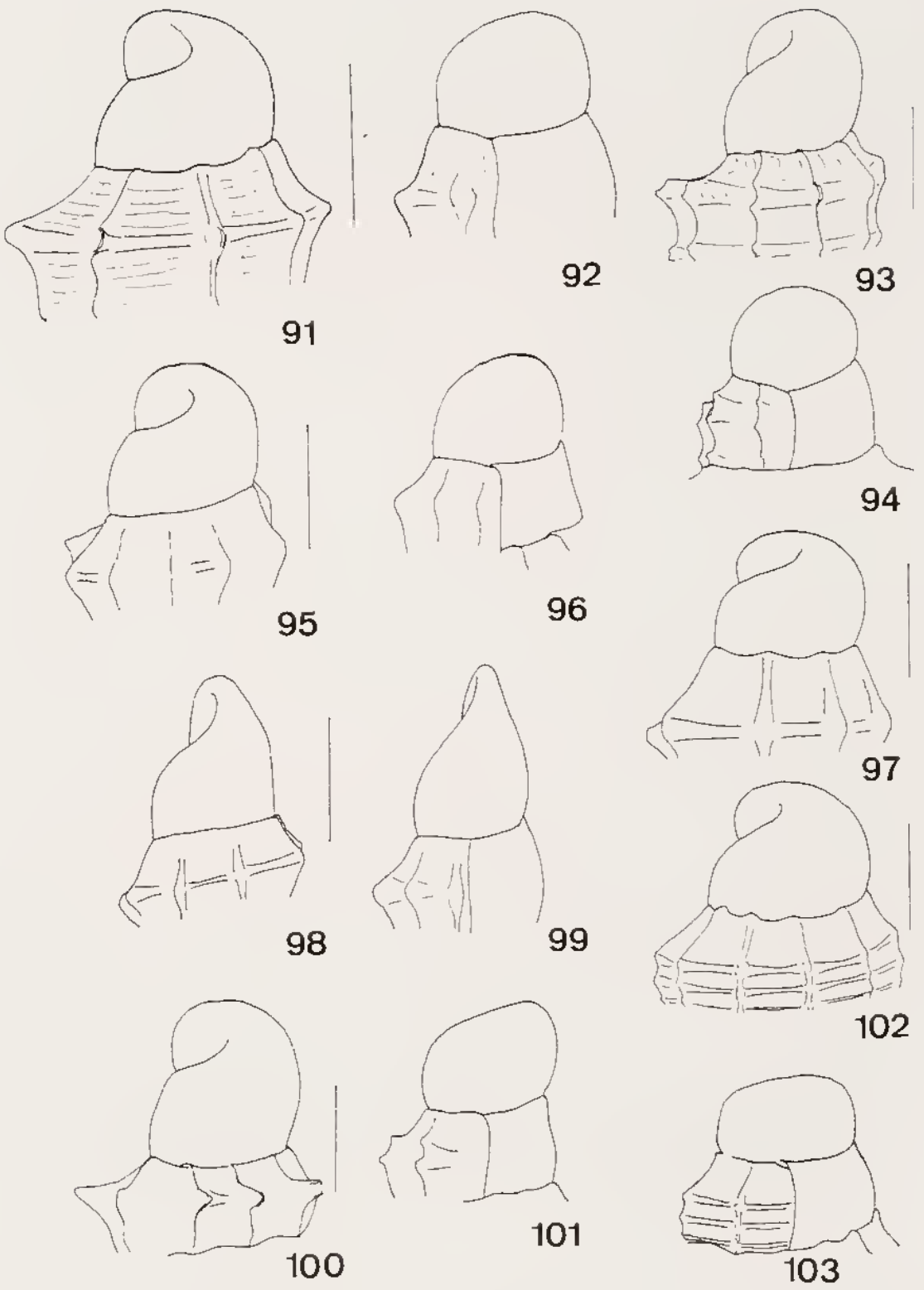
MATERIAL EXAMINED. — Only known from the type material.

Source : MNHN, Paris



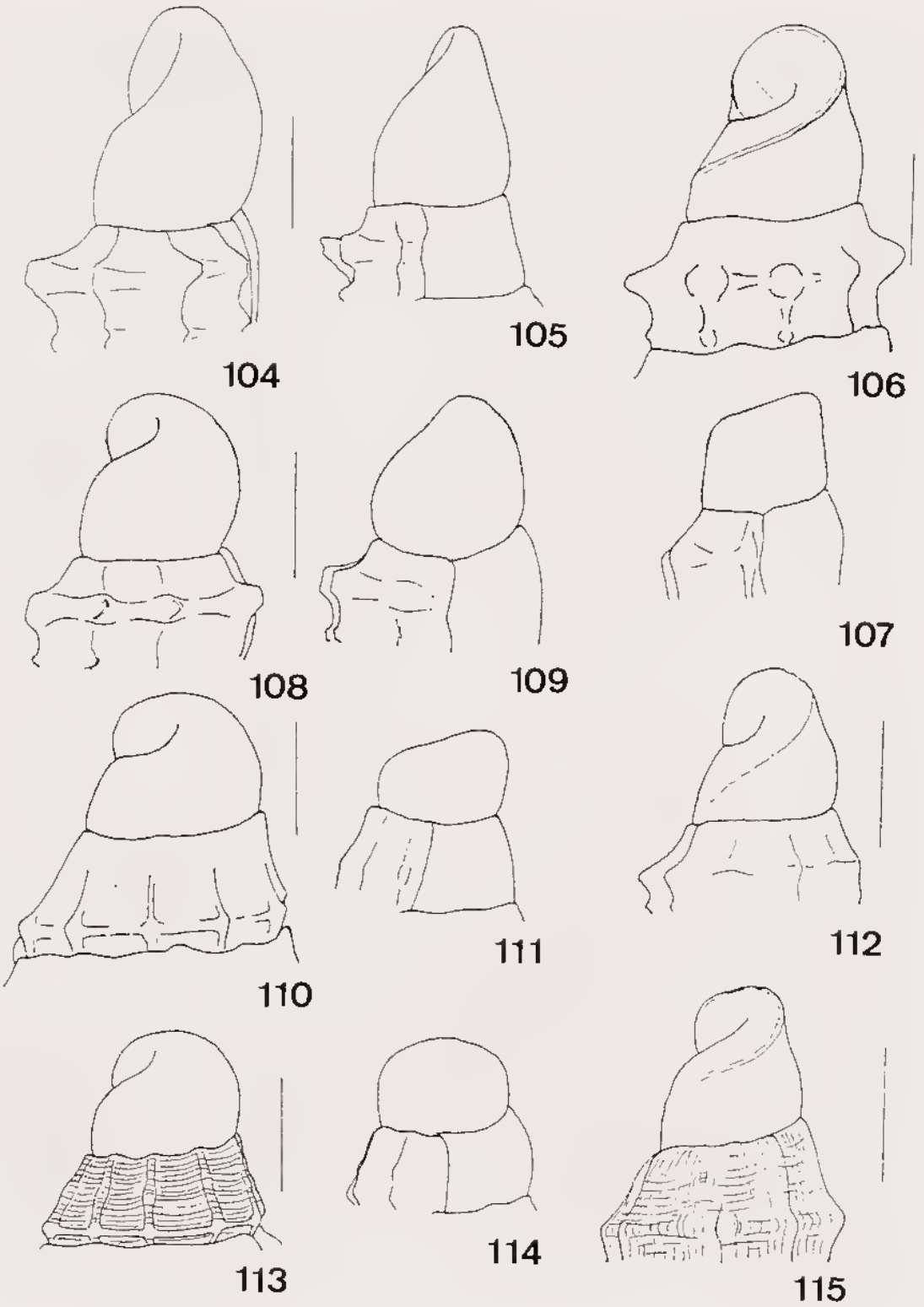
FIGS 80-90. — Genera *Conchatalos*, *Apixystus* and *Litozonia*. — **80**, *Conchatalos lacrima*, holotype, 9 mm. — **81-82**, *C. tirardi*, holotype, 13 mm. — **83**, *C. vaubani* sp. nov., holotype, 10.5 mm. — **84-85**, *C. canalibrevis* sp. nov., holotype, 5.9 mm. — **86-89**, *Apixystus leptos* sp. nov. — 86-87, holotype, 4.7 mm. — 88-89, paratype, MUSORSTOM 5: stn 346, 3.9 mm. — **90**, *Litozamia tropis* sp. nov., holotype, 3.3 mm.

Source : MNHN, Paris



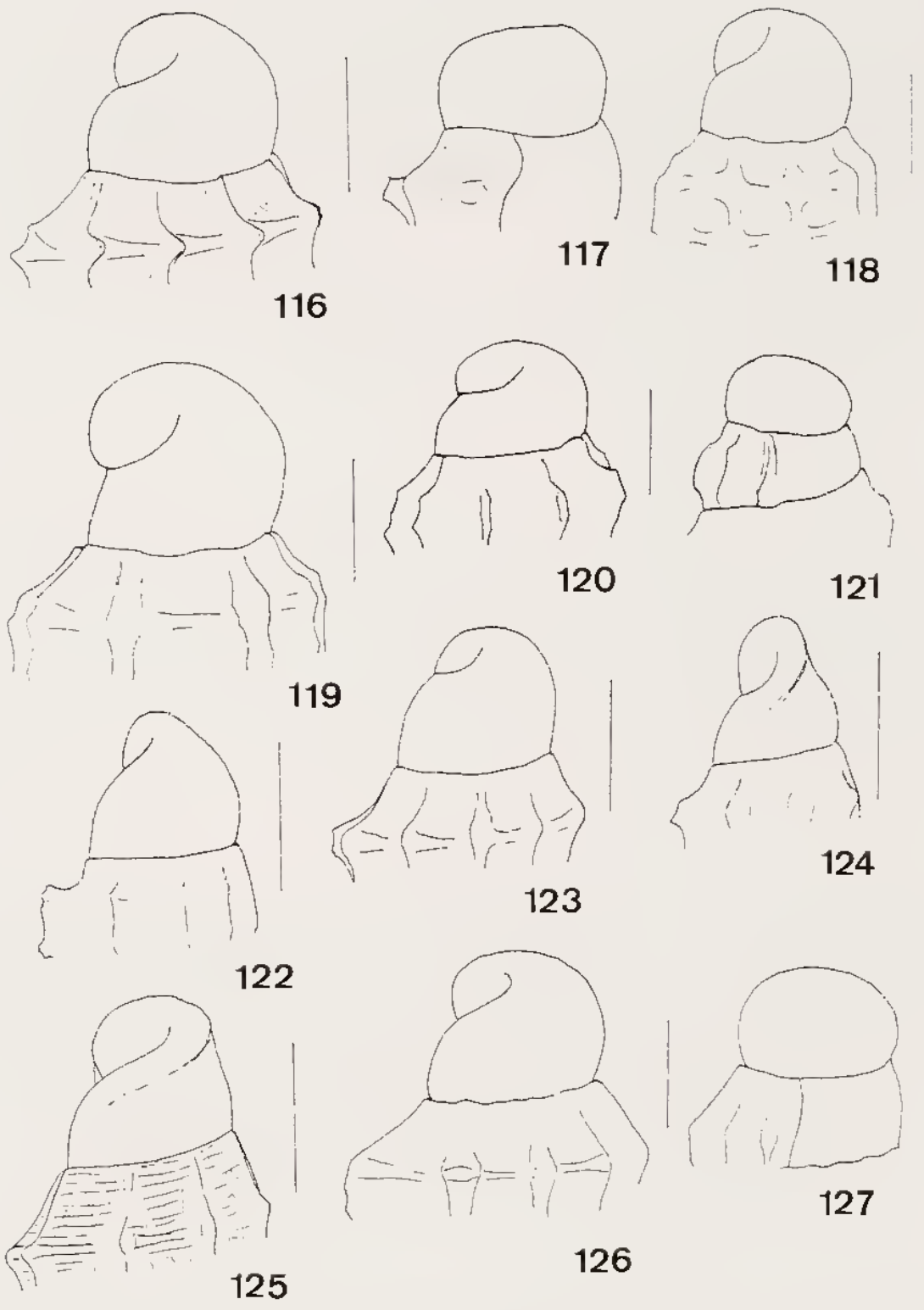
FIGS 91-103. Protoconchs. — **91-92**, *Leptotrophon caroae* sp. nov. **93-94**, *L. levii* sp. nov. — **95-96**, *L. spinuratus*. **97**, *L. ruledonicus* sp. nov. — **98-99**, *L. acerapex*. — **100-101**, *L. rigidus* sp. nov. — **102-103**, *L. lineorugosus* sp. nov. Scale lines 0.5 mm.

Source : MNHN, Paris



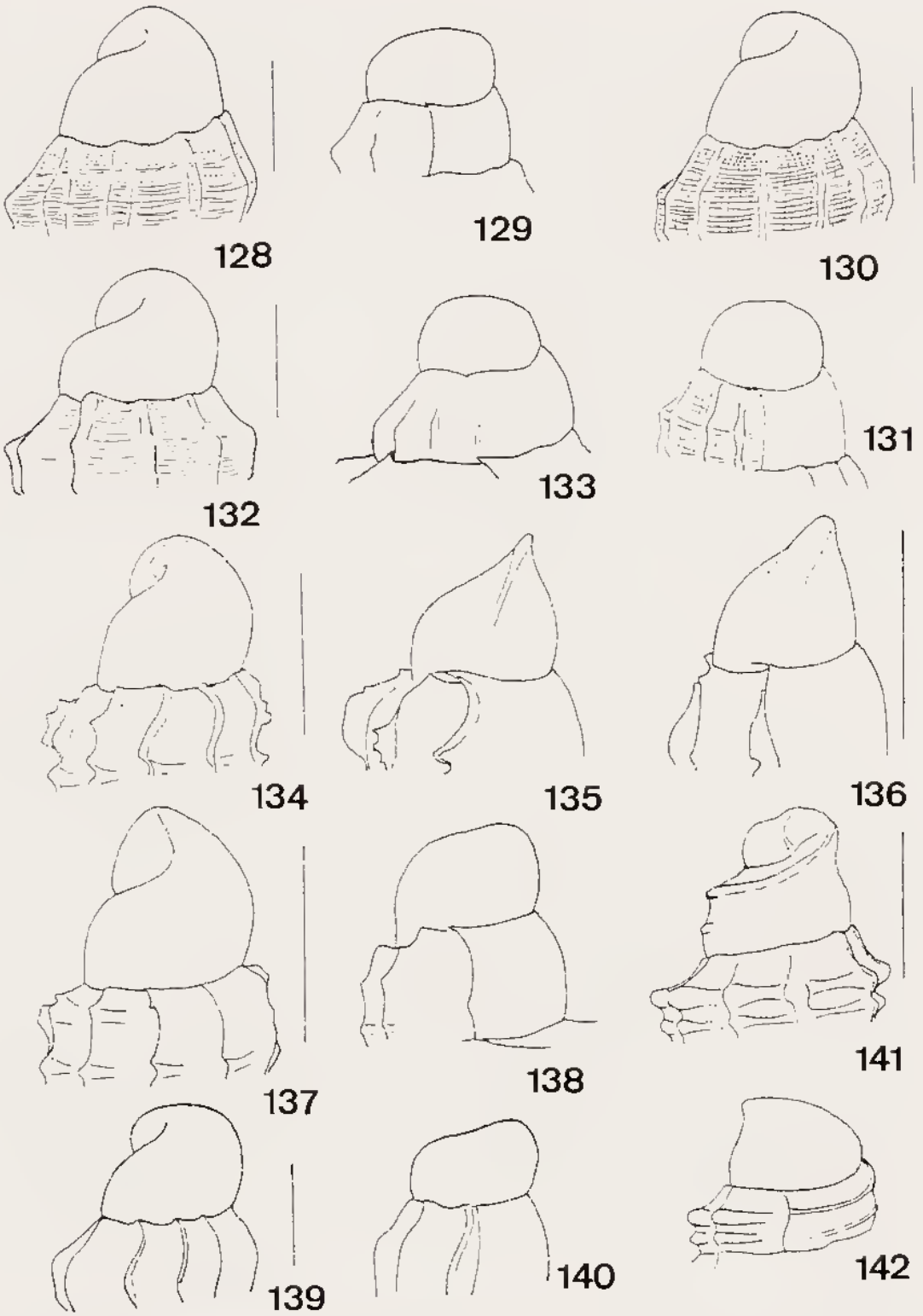
FIGS 104-115. — Protoconchs. – **104-105**, *Leptotrophon bernadettae* sp. nov. — **106-107**, *L. protocarinatus* sp. nov. — **108-109**, *L. charcoti* sp. nov. — **110-111**, *L. surprisensis* sp. nov. — **112**, *L. virginiae* sp. nov. — **113-114**, *L. marshalli* sp. nov. — **115**, *L. inaequalis* sp. nov. Scale lines 0.5 mm.

Source : MNHN, Paris



FIGS 116-127. — Protoconchs. — **116-117**, *Leptotrophon coriolis* sp. nov. — **118**, *L. richeri* sp. nov. — **119**, *L. musorstomae* sp. nov. — **120-121**, *L. coralensis* sp. nov. — **122**, *L. metivieri* sp. nov. — **123**, *L. minispinosus* sp. nov. — **124**, *L. biocalae* sp. nov. — **125**, *L. turritellatus* sp. nov. — **126-127**, *Conchatalus tirardi*. Scale lines 0.5 mm.

Source : MNHN, Paris



FIGS 128-142. — Protoconchs. — **128-129**, *Conchatalos lacrima*. — **130-131**, *C. vaubani* sp. nov. — **132-133**, *C. canalibrevis* sp. nov. — **134-136**, *Apixystus leptos* sp. nov. — 134-135, Holotype. — 136, AMS C21787, Queensland, Australia. — **137-138**, *A. stimuleus*, holotype AMS C25787, New South Wales, Australia. — **139-140**, *Trophonopsis multigradus*. — **141-142**, *Litozaniia tropis* sp. nov. Scale lines 0.5 mm.

Source : MNHN, Paris

DISTRIBUTION. — Only known from the type locality, northeastern New Caledonia, in 110 m; not recorded alive.

DESCRIPTION. — *Shell* up to 3.4 mm in length, spinose. Spire high with 1.5-1.75 protoconch whorls and up to 3 shouldered teleoconch whorls. *Protoconch* dull, sculptured with 2 spiral keels, abapical keel low and weak; terminal varix, shallow, delicate. *Teleoconch* suture impressed. Axial sculpture consisting of heavy rounded, spinose varices. First and second whorls with 8 or 9 varices, last whorl with 6 or 7 varices bearing open, short shoulder spine. Spiral sculpture consisting of low cords, more apparent on varices: 2 on first and second whorl, 3 or 4 on last whorl. Other spiral sculpture of numerous threads between each pair of cords. 1 cord and numerous threads on shoulder. Aperture ovate. Columellar lip smooth, rim completely adherent. Anal notch shallow, narrow, delineated by small node. Outer lip erect, smooth, weakly lirate for short distance within. Siphonal canal short, narrow, abaperturally bent, narrowly open, with 2 or 3 spiral cords and numerous threads. Beige. *Radula* unknown.

REMARKS. — *Litozamia tropis* differs from *L. rudolphi* (Brazier, 1894) in its double keel on the protoconch, and in having spirally striate, more strongly shouldered and spiny shell. The protoconch in both species have the same number of whorls, but that in *L. tropis* is about half the size.

ETYMOLOGY. — *Tropis* (Greek) = keel.

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Source : MNHN, Paris

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Source : MNHN, Paris

7

A review of the deep-water volute genus *Calliotectum* (Gastropoda: Volutidae)

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ABSTRACT

Calliotectum Dall, 1890, until now a monotypic deep-water volute genus from the Eastern Pacific, is shown to be a senior synonym of *Teramachia* Kuroda, 1931 from the Western Pacific. *Pakaurangia* Finlay, 1926 (originally Thiaridae; Miocene of New Zealand) and *Butonius* Martin, 1933 (originally Fusinidae; Neogene of Indonesia) are new synonyms. *Calliotectum* has a fossil record in the Neogene of the Pacific region (Okinawa, Indonesia, New Zealand and Ecuador), with a total of 5 species. All fossil records are from deep-water facies. Seven Recent species of *Calliotectum* are recognised, all from deep water in tropical latitudes. Three species occur in South-East Asia and the Eastern Indian Ocean, at 200-1660 m depth. Of these, *C. tibiaeforme* is treated as a polytypic species, with *C. johnsoni* and *C. dupreyae* considered to be geographical forms. *Calliotectum piersmorum* sp. nov. and *C. egregium* sp. nov. are described from the South-West Pacific at 450-1060 m depth. Single species occur each in the East Pacific and in the Caribbean.

RÉSUMÉ

Révision des volutes bathyales du genre *Calliotectum* (Gastropoda: Volutidae).

Calliotectum Dall, 1890 était jusqu'ici considéré comme un genre monotypique de Volutidae du Pacifique oriental. Sa synonymie comprend désormais *Pakaurangia* Finlay, 1926 (décrit comme Thiaridae ; Miocène de Nouvelle-Zélande), *Teramachia* Kuroda, 1931 (du Pacifique occidental), et *Butonius* Martin, 1933 (décrit comme Fusinidae ; Néogène d'Indonésie). Cinq espèces sont connues de formations néogènes à faciès bathyal de la région Pacifique : Okinawa, Indonésie, Nouvelle-Zélande, Equateur. Le genre *Calliotectum* est représenté par 7 espèces actuelles d'eau profonde aux latitudes

BOUCHET, P. & POPPE, G., 1995. — A review of the deep-water volute genus *Calliotectum* (Gastropoda: Volutidae). *In*: P. BOUCHET (ed.), Résultats des Campagnes MUSORSTOM, Volume 14. *Mém. Mus. natn. Hist. nat.*, 167: 499-525. Paris ISBN 2-85653-217-9

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Source : MNHN, Paris

tropicales. Trois espèces vivent en Asie du Sud-Est et dans l'Est de l'océan Indien, entre 200 et 1660 m. *Calliotectum tibiaeforme* est traité comme une espéce polytypique, et *C. johnsoni* et *C. dupreyae* sont considérés comme de simples variants géographiques. *Calliotectum piersonorum* sp. nov. et *C. egregium* sp. nov. sont décrits du Sud-Ouest Pacifique, par 450-1060 m. Enfin, deux espéces sont présentes, l'une dans le Pacifique oriental, l'autre dans le domaine caraïbe.

INTRODUCTION

Until now, volutes of the genus *Calliotectum* Dall, 1890 have been referred by shell collectors and malacologists working on Recent faunas to the genus *Teramachia* Kuroda, 1931. For many years, these volutes were rare in public and private collections. At the time of the monograph by WEAVER & DUPONT (1970), *Teramachia dalli, T. johnsoni, T. mirabilis* and *T. smithi* were altogether known by only seven specimens collected between 1910 and 1940. Only the fifth nominal species, *T. tibiaeformis* was known from large numbers. Since 1970, several thousand specimens have been taken in South-East Asia (GREENE, 1975) and later from new fishing grounds off Western Australia (SLACK-SMITH, 1982; DOUTÉ, 1990), which led to the description of new species and/or subspecies. The present revision was initiated when new material of *Calliotectum* was discovered in deep water in the South-West Pacific, which subsequently led to the reevaluation of the nominal taxa.

The reason for the apparent scarcity of *Calliotectum* is that they are among the deepest-living volutes. HARASEWYCH & KANTOR (1991) listed only 8 volute species reported from depths greater than 2000 m. Species of *Calliotectum* all occur between 200 and 1660 m depth, with *C. tibiaeforme* occasionally ranging shallower. In South-East Asia and Western Australia, examples of *Calliotectum* species appear to be not particularly rare on soft bottoms. Conversely, even at appropriate depths, specimens are scarce off New Caledonia, where hard bottoms predominate. From a total of 154 dredge hauls and trawlings made between 500 and 900 m in New Caledonia in 1985-1989 (RICHER DE FORGES, 1990), 14 hauls yielded a total of 18 specimens; of 427 hauls between 200 and 500 m, only one (448 m) yielded one shell of *Calliotectum*, and 102 hauls deeper than 900 m were all negative.

In the present paper, we review the generic synonymy of *Calliotectum*; we revise the taxonomy of the Indo-Pacific species, including the description of two new species from the SW Pacific, and we list the nominal fossil species.

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

LACM : Los Angeles County Museum of Natural History, Los Angeles
MNHN : Muséum national d'Histoire naturelle, Paris
NZGS : Institute of Geological and Nuclear Sciences [formerly New Zealand Geological Survey], Lower Hutt
NZOI : National Institute of Water and Atmospheric Research [formerly New Zealand Oceanographic Institute], Wellington
RMNH : Nationaal Natuurhistorisch Museum, Leiden
USNM : National Museum of Natural History, Washington DC

Other abbreviations

lv : live-collected specimen
dd : dead-collected specimen
shell : empty shell, condition unknown at time of collect.

Source : MNHN, Paris

Family VOLUTIDAE Rafinesque, 1815

Subfamily CALLIOTECTINAE Pilsbry & Olsson, 1954

Suprageneric classification

DALL (1890) believed *Calliotectum* to lack a radula and placed the genus in the family Pleurotomidae [= Turridae], where it stayed until THIELE (1929: 345) transfered it to Volutidae. PILSBRY & OLSSON (1954: pl. 3, fig. 16) examined the radula of a syntype of the type species and erected the subfamily Calliotectinae, placing *Teramachia* (and its synonym *Prodallia*) and *Howellia* in that subfamily. This classification was followed by WEAVER & DUPONT (1970). Subsequently, BAYER (1971) transfered *Teramachia* to the family Turbinellidae, based on interpretation of the radulae of *Teramachia meekiana* (Dall, 1889) and *Teramachia chaunax* Bayer, 1971. This opinion was followed by BEU & MAXWELL (1990), who classified Calliotectinae as a subfamily of Turbinellidae, to include *Pakaurangia*, which they recognized as a senior synonym of *Teramachia*.

As had already been pointed out by EMERSON & OLD (1979), this placement cannot be maintained. BAYER (1971) and BEU & MAXWELL (1990) were mistaken in including *Teramachia meekiana* and *T. chaunax* in the genus *Teramachia*. The radula of these species is triserial and, indeed, shows great similarity to the radula of *Turbinella pyrum* (Linnaeus, 1758). The close similarity between the Atlantic species *T. meekiana* and *T. chaunax* and the Pacific *T. barthelowi* (Bartsch, 1942) in shell morphology led QUINN (1981) to place them in a new turbinellid genus, *Cyonesus*. We agree with the view (REHDER, 1972) that *Teramachia barthelowi*, *T. meekiana* and *T. chaunax* are turbinellids, properly placed in the genus *Latiromitra* Locard, 1897 [type species: *L. specialis* Locard, 1897], of which *Cyonesus* Quinn, 1981 is a synonym (BOUCHET & WARÉN, 1985).

The radulae of *Calliotectum vernicosum*, *Teramachia tibiaeformis* and *T. dalli* were figured by PILSBRY & OLSSON (1954), HABE (1952) and WELLS (1989) respectively. The radula of a specimen of *T. dalli* 161 mm high is 3.6 mm long, and bears 57 tricuspid rachidian teeth, and the radula of a specimen of *T. tibiaeforme* 140 mm high is 3.2 mm long, and bears 50 teeth (WELLS, 1989). The central cusp is similar to (*C. vernicosum*) or longer than (other species) the lateral cusps. The base of each cusp has a shallow socket into which the cusps from the preceeding row interlocks. The radulae of the various species (Figs 1-9) are all similar (as already recognized by REHDER, 1972) and indicate that Calliotectinae belongs in the family Volutidae, not Turbinellidae. For radulae of Turbinellidae, see BOUCHET & WARÉN (1985, 1988) and HARASEWYCH (1987).

There are thus two groups of species that, at times, have been placed in, or associated with, the name *Teramachia*: (1) the species of *Latiromitra* (*L. barthelowi*, *L. chaunax*, *L. meekiana*, and *L. specialis*), properly classified in Turbinellidae; (2) true volutes with monoseriate radulae, which are revised in the present paper.

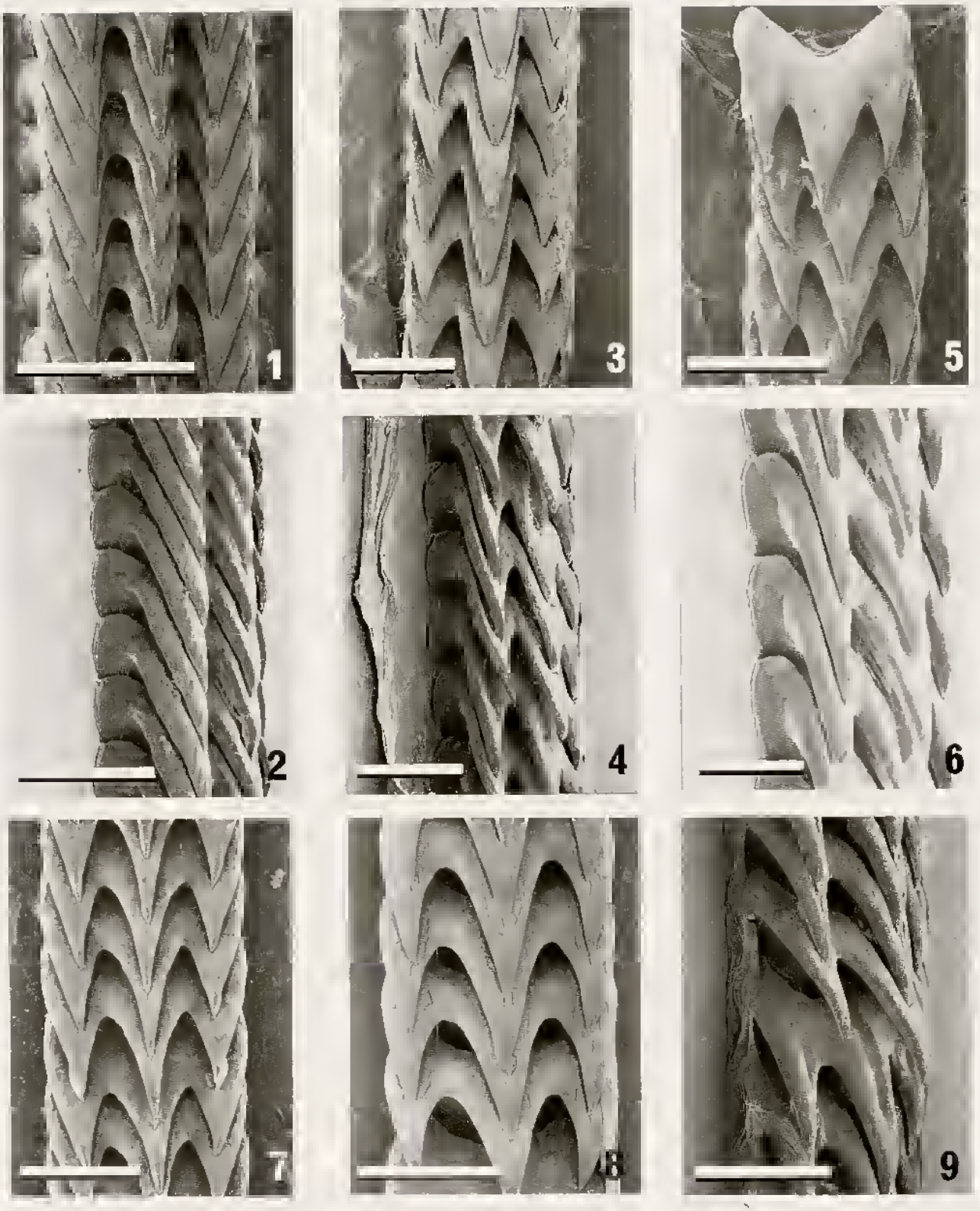
Generic nomenclature

Genus ***Calliotectum*** Dall, 1890

Mangilia (Calliotectum) Dall, 1890: 304. Type species (OD): *Calliotectum vernicosum* Dall, 1890: Galapagos, Recent.

Although DALL (1890) formally introduced *Calliotectum* as a subgenus of *Mangilia*, he used the binomen *Calliotectum vernicosum* in the text and legend to the illustration. Until recently *Calliotectum vernicosum* was known only from the original two syntypes, but Dr J. MCLEAN has brought together several fine lots of this species, including live-taken specimens and large adults, which permit a reevaluation of the taxon.

Source : MNHN, Paris



FIGS 1-9. — Radulae of *Calliotectum*. — **1-2,** *C. vernicosum*, Peru, 1200 m. — **3-4,** *C. dalli*, Philippines, MUSORSTOM 2: stn CP 81. — **5-6,** *C. egregium*, Wallis, MUSORSTOM 7: stn CP 562. — **7,** *C. piersonorum*, New Caledonia, BIOCAL: stn DW 51. — **8-9,** *C. tibiaeforme*, Arafura Sea, KARUBAR: stn CP 83. Scales lines 100 µm (1-5, 7-9) and 50 µm (6).

Source : MNHN, Paris

Pakaurangia Finlay, 1926 **(syn. nov.)**. Type species (OD): *Melanopsis waitaraensis* Marwick, 1926; New Zealand, Tongaporutuan (Tortonian; Late Miocene).

Pakaurangia was first introduced as a genus of Thiaridae (Cerithioidea). WENZ (1939: 692) even made *Pakaurangia* a subgenus of *Melanopsis* and FLEMING (1966: 47) also accepted it as a genus of Thiaridae. BEU & MAXWELL (1990) penetratingly recognized *Pakaurangia* as an earlier synonym of *Teramachia*, transferred it to the subfamily Calliotectinae, by them included in the family Turbinellidae (see above), and emphasized the deep-water origin of the deposits containing the type species.

Teramachia Kuroda, 1931. Type species (by monotypy): *Teramachia tibiaeformis* Kuroda, 1931. Japan, Recent.

OLSSON (1964) placed *Teramachia* in the synonymy of *Calliotectum*, but his opinion was subsequently ignored. Based on a comparison of adult *Teramachia* species with the juvenile syntypes of *Calliotectum vernicosum*, EMERSON & SAGE (1986) explicitly refuted this synonymy and maintained the distinction between the two genera. Even when full grown specimens of both genera are considered, *Teramachia tibiaeformis* differs from *Calliotectum vernicosum* by its appressed instead of channelled suture; flaring and moderately thickened instead of sharp outer lip; well instead of weakly demarcated siphonal canal; rather low, broad axial ribs; and thinner more lightly coloured periostracum. However, these differences become insignificant when additional species are considered. In *C. piersonorum*, the outer lip is thickened as in *Teramachia tibiaeformis*, but the siphonal canal is very short as in *Calliotectum vernicosum*. In *Calliotectum dalli*, the suture is channelled as in *C. vernicosum*, but the outer lip is flared and thickened as in *Teramachia tibiaeformis*. We consider the differences enumerated to be of specific rather than generic importance, and formally synonymize *Teramachia* with *Calliotectum*.

Butonius Martin, 1933 **(syn. nov.)**. Type species (by monotypy): *Fusus (Butonius) pectinatus* Martin, 1933; Indonesia, Late Miocene-Pliocene.

Butonius was introduced as a subgenus of *Fusus* to include *F. pectinatus*, originally described based on a single shell from the Waisiu deposits of Buton Island, Central Indonesia. BEETS (1942: 284) added a second species, *F. (Butonius) perinusitatus*, based on new material from the Kahungka deposits of the same island, and recorded a second shell of the type species.

Fusus pectinatus and *Calliotectum vernicosum* differ by the absence of a labial varix in *F. pectinatus* and lack of demarcated siphonal canal in *C. vernicosum*. Otherwise, the two share the same general shell morphology, sculpture of broad axial ribs separated by deep grooves and deeply channeled suture. *F. pectinatus* is probably directly ancestral to *Calliotectum dalli*, and it is therefore relevant to compare anatomical characters of *C. dalli* with those of *C. vernicosum*. Radular teeth show only subtle differences in the proportion of the central vs. lateral cusps (Figs 1-4) and the two species share digitate osphradial leaflets, a character so far unique in the Volutidae (M.G. HARASEWYCH, comm. pers.). Based on these characters, we synonymize *Butonius* with *Calliotectum*.

Howellia Clench & Aguayo, 1941. Type species (OD): *Howellia mirabilis* Clench & Aguayo, 1941; Caribbean, Recent.

The similarity of *Howellia mirabilis* to *Teramachia* species was noted by CLENCH & TURNER (1964), and they were formally synonymized by WEAVER & DUPONT (1970: 176).

Prodallia Bartsch, 1942. Type species (OD): *Prodallia dalli* Bartsch, 1942; Philippines, Recent.

The unavailability of the name *Prodallia* in a 1915 banquet brochure has been discussed by MACNEIL (1961). *Prodallia* was first validly introduced in 1942, and synonymized with *Teramachia* by PILSBRY & OLSSON (1954), an opinion which has been followed by all subsequent authors.

Source : MNHN, Paris

Species revision

Included species:

Calliotectum dalli (Bartsch, 1942); Taiwan to NW Australia, Recent [= *C. pectinatum*?]
C. egregium sp. nov.; SW Pacific, Recent
C. fischeri (Olsson, 1964); Ecuador, Pliocene
C. pectinatum (Martin, 1933); Indonesia, Pliocene
C. marci (Koperberg, 1931); Indonesia, Plio-Pleistocene
C. mirabile (Clench & Aguayo, 1941); Caribbean, Recent
C. piersonorum sp. nov.; New Caledonia, Recent
C. shinzatoense (MacNeil, 1961); Okinawa, Pliocene [= *C. marci*?]
C. smithi (Bartsch, 1942); Philippines, Recent
C. tibiaeforme (Kuroda, 1931); S Japan to W Australia and SW Pacific, Recent [= *C. marci*?]
C. verrucosum Dall, 1890; Peru-Ecuador, Recent
C. waitaraense (Marwick, 1926); New Zealand, Miocene.

A total of 5 Neogene and 7 Recent species of *Calliotectum* are known. The Indo-Pacific species are reviewed in detail below, including description of two new Recent species. For the East Pacific and Caribbean taxa, we refer to EMERSON & SAGE (1986) who provided excellent illustrations of the species involved.

Excluded species: to be classified in *Latiromitra* Locard, 1897 (Turbinellidae)
Teramachia barthelowi (Bartsch, 1942)
T. chaunax Bayer, 1971
T. meekiana (Dall, 1889).

Calliotectum dalli (Bartsch, 1942)

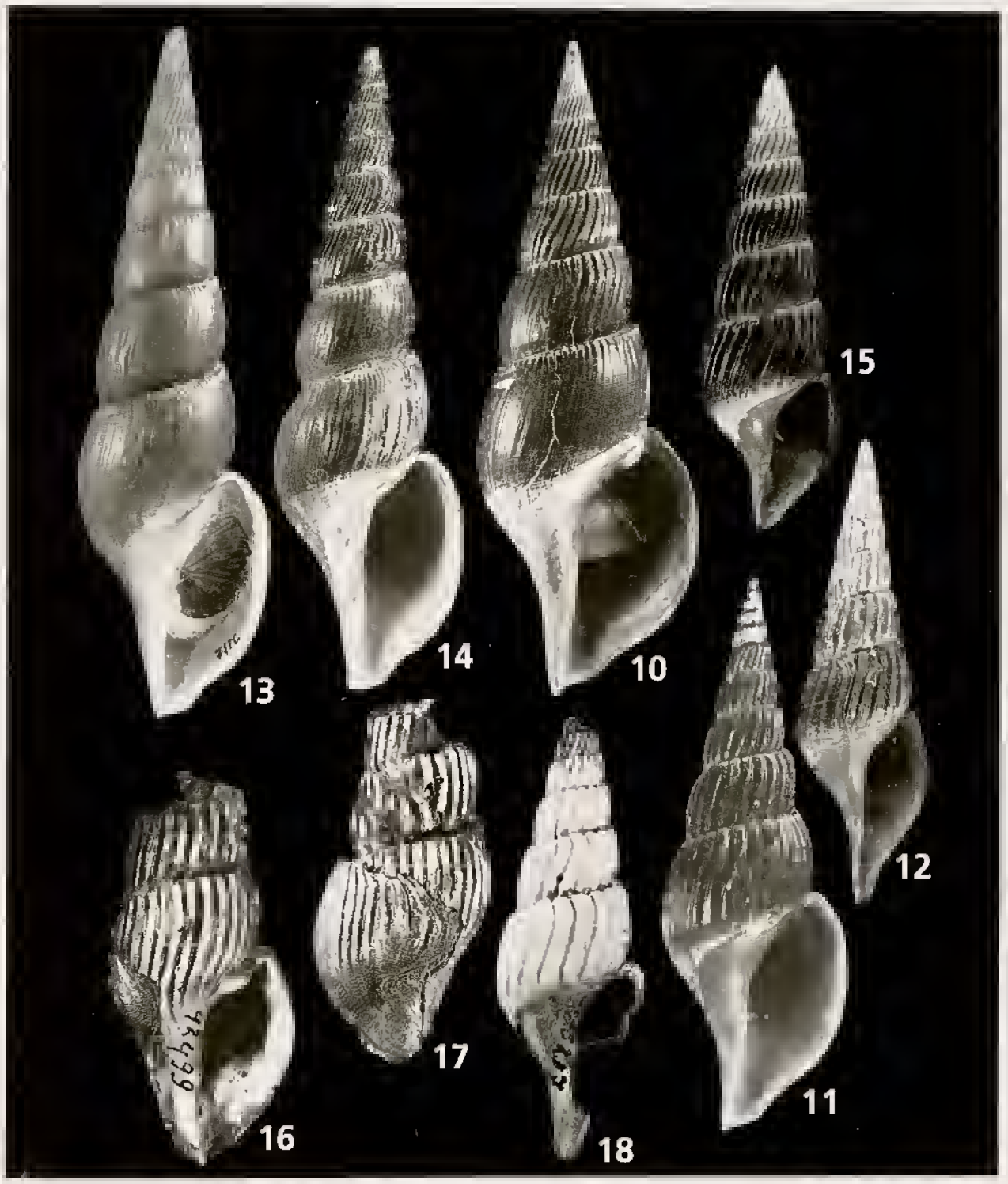
Figs 3-4, 10-15

C. dalli is very distinctive, and differs from all other Recent *Calliotectum* by its deep sutural channel and thick, dark, shiny periostracum. For many years the type specimens, taken in the Philippines by the "*Albatross*" expedition (1915), were the only known specimens and the species has remained very rare in public and private collections, until the discovery of Australian populations in the mid 1980s.

Australian shells differ from Philippine shells by their paler brown colour, and in that shells of the same size have more whorls (although this is difficult to quantify because the top whorls are always broken), which are much flatter. Philippine shells are dark olive brown, have a much broader outline and more convex whorls.

These differences led to the description of *C. dalli claydoni* as a geographical subspecies. This distinctness has been challenged by WELLS (1989), who synonymized *C. dalli claydoni* with *C. dalli dalli*. WELLS' arguments were that measurements of the holotype of *C. dalli* fit within the range of variation of the Australian material, and that convexity of the whorls was also a variable feature. We agree with WELLS that recognition of subspecies may vary with the taxonomic judgment of the malacologist examining the shells. However, we have now seen additional material from the Philippines and Taiwan, and several hundred Australian *claydoni* in private collections. We find that we can tell the geographical origin of every single shell, based on conchological characteristics. As long as no material is available from the large geographical gap between the Taiwan-Philippine region, on one hand, and NW Australia-Arafura Sea, on the other hand, we prefer to maintain the subspecific status of the two groups of populations.

Source : MNHN, Paris



FIGS 10-18. — *Calliotectum*. — **10**, *C. dalli dalli*, Philippines, MUSORSTOM 2: stn CP 79, 128 mm. — **11**, *C. dalli dalli*, Philippines, MUSORSTOM 2: stn CP 50, small adult, 84 mm. — **12**, *C. dalli dalli*, Philippines, MUSORSTOM 2: stn CP 38, juvenile 47 mm. — **13**, *C. dalli claydoni*, Western Australia, off Port Hedland, 137 mm. — **14**, *C. dalli claydoni*, Arafura Sea, KARUBAR: stn CP 70, 132 mm. — **15**, *C. dalli claydoni*, Arafura Sea, KARUBAR: stn CP 91, juvenile, 50 mm. — **16-17**, *C. pectinatum*, holotype of *Fusus perinusitatus*, Neogene of Buton, 62 mm. — **18**, *C. pectinatum*, Neogene of Buton, syntype RMNH 15217, 63 mm.

Source : MNHN, Paris

Calliotectum pectinatum may be the valid name of this species (see Remarks under that name).

Calliotectum dalli dalli (Bartsch, 1942)

Figs 3-4, 10-12

Prodallia dalli Bartsch, 1942: 10-11, pl. 2, figs 1, 4.

TYPE MATERIAL. — Holotype USNM 231758.

TYPE LOCALITY. — *"Albatross"* stn 5119, off Cape Santiago, Luzon, 725 m [394 fms].

MATERIAL EXAMINED. — Off Taiwan, 1 dd (coll. Goto).
Philippines. MUSORSTOM 2: stn CP 38, 12°53′ N, 122°27′ E, 1650-1660 m, Sibuyan Sea, 1 juv. lv. — Stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, off NW Mindoro, 1 lv, 1 dd. — Stn CP 79, 13°44′ N, 120°32′ E, 682-770 m, off NW Mindoro, 2 lv, 1 dd (figured by BOUCHET, 1981: 10). — Stn CP 81, 13°34′ N, 120°31′ E, 856-884 m, Sibuyan Sea, 1 lv (all MNHN).

DISTRIBUTION. — South of Taiwan and the Central Philippines (not recorded from the Southern Philippines), alive in 770-1650 m. Other than the material examined, *C. dalli* is known from *"Albatross"* stn 5248, off Lubang Island, 776 m [422 fms], USNM 231759 (BARTSCH, 1942) and off SW Taiwan, 200-400m (LAN, 1980).

REMARKS. — The size of adult shells (with expanded thickened outer lip) varies considerably. The sample, however, is too small for us to determine if this variation is geographical, bathymetrical, or individual. The largest shell is 163 mm high and comes from 682-770 m (MUSORSTOM 2: stn CP 79), the smallest is 79 mm high and comes from 856-884 m (MUSORSTOM 2: stn CP 81).

Calliotectum dalli claydoni (Poppe, 1986)

Figs 13-15

Teramachia dalli claydoni Poppe, 1986: 27-37, pls 2, 3.

TYPE MATERIAL. — Holotype in the Western Australian Museum.

TYPE LOCALITY. — 280 km north-east of Port Hedland, Western Australia in about 475 m ("250 fms").

MATERIAL EXAMINED. — The type material and 7 shs from off Scott Reef and off Broome, Western Australia (Coll. Douté, Bail, Goto).
Indonesia. KARUBAR: stn CC 40, 07°46′ S, 132°31′ E, 443-468 m, 1 dd. — Stn CC 56, 08°16′ S, 131°59′ E, 552-549 m, 2 lv, 3 dd. — Stn CC 57, 08°19′ S, 131°53′ E, 603-620 m, 1 dd. — Stn CP 69, 08°42′ S, 131°53′ E, 356-368 m, 1 dd. — Stn CP 70, 08°41′ S, 131°47′ E, 410-413 m, 3 lv, 1 dd. — Stn CP 72, 08°36′ S, 131°33′ E, 676-699 m, 4 lv, 1 dd. — Stn CP 73, 08°29′ S, 131°33′ E, 840-855 m, 2 dd. — Stn CP 77, 08°57′ S, 131°27′ E, 346-352 m, 1 dd. — Stn CP 91, 08°44′ S, 131°05′ E, 884-891 m, 1 lv, 3 dd.

DISTRIBUTION. — Along the continental slope off the Arafura Sea, (between Irian Jaya and Australia) to 18°53′ S-116°10′ E, alive in 413-884 m, shells from 296 m (WELLS, 1989; this paper).

REMARKS. — Adult *C. dalli claydoni* measure between 125 and 174 mm in shell height.

Source : MNHN, Paris

Calliotectum egregium sp. nov.

Figs 5-6, 19-24, 64-65

TYPE MATERIAL. — Holotype in MNHN.

TYPE LOCALITY. — BATHUS 3, stn CP 767, 22°11′ S, 165°59′ E, 1060-1450 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DC 168. 18°48′ S, 163°11′ E, 720 m, North of New Caledonia, 2 lv.
BATHUS 1: stn CP 661, 21°05′ S, 165°50′ E, 960-1100 m, 1 lv.
BATHUS 3: stn CP 767, 22°11′ S, 165°59′ E, 1060-1450 m. 1 lv (holotype). — Stn DW 789, 23°51′ S, 169°49′ E, 671-674 m, 1 dd. — Stn CP 844, 23°06′ S, 166°46′ E, 908 m, 1 lv small adult. — Stn CC 848, 23°02′ S, 166°53′ E, 680-700 m, 1 lv subadult.
Loyalty Islands. MUSORSTOM 6: stn DW 489 and stn DW 493, 20°48′ S, 167°06′ E, 700 m, 2 dd.
Vanuatu. MUSORSTOM 8: Stn DW 987, 19°23'S, 169°35′ E, 1040-1050 m, 1 juv. lv. — Stn CP 993, 18°49′ S, 168°54′ E, 780-783 m, 1 juv. lv. — Stn CP 994, 18°48′ S, 168°56′ E, 641-649 m, 1 juv. lv. — Stn CC 996, 18°52′ S, 168°56′ E, 764-786 m. 1 adult and 1juv. lv. — Stn CP 1035, 17°56′ S, 168°44′ E, 765-780 m, 1 small adult lv. — Stn CC 1056, 16°33′ S, 167°56′ E, 602-620 m, 1 lv. — Stn CP 1080, 15°57′ S, 167°28′ E, 799-850 m, 2 lv subadults.
Wallis and Futuna. MUSORSTOM 7: stn DW 523, 13°12′ S, 176°16′ W, 455-515 m, 1 juv. dd. — Stn DW 534, 12°23′ S, 176°42'W, 440-500 m, 1 old dd. — Stn DW 535, 12°30′ S, 176°41′ W, 340-470 m, 1 juv. dd. — Stn DW 539, 12°27′ S, 177°27′ W, 700 m, 1 juv. dd. — Stn DW 540, 12°27′ S, 177°28′ W, 600 m, 1 juv. dd. — Stn DW 547, 12°26′ S, 177°26′ W. 455 m, 1 juv. dd. — Stn CP 552, 12°16′ S, 177°28′ W, 786-800 m, 1 juv. lv. — Stn DW 557, 11°48′ S, 178°18′ W, 600-608 m, 1 juv. dd., 1 fragm. — Stn CP 562, 11°48′ S, 178°22′ W, 775-777 m, 1 juv. lv. — Stn CP 564, 11°46′ S, 178°27′ W, 1015-1020 m, 2 fragm. — Stn CP 567, 11°47′ S, 178°27′ W, 1010-1020 m, 1 juv. lv. — Stn DW 571, 12°31′ S, 176°52′ W, 502-508 m, 1 juv. lv. — Stn DW 626, 11°54′ S, 179°32′ W, 597-600 m, 1 juv. lv.
Kermadec Islands. R.V. *"Tangaroa"*, NZOI stn P946, Colville Ridge, 25°59′ S, 179°18′ W, 660 m, 1 dd (NZOI).

DISTRIBUTION. — SW Pacific, alive in 500-1060 m.

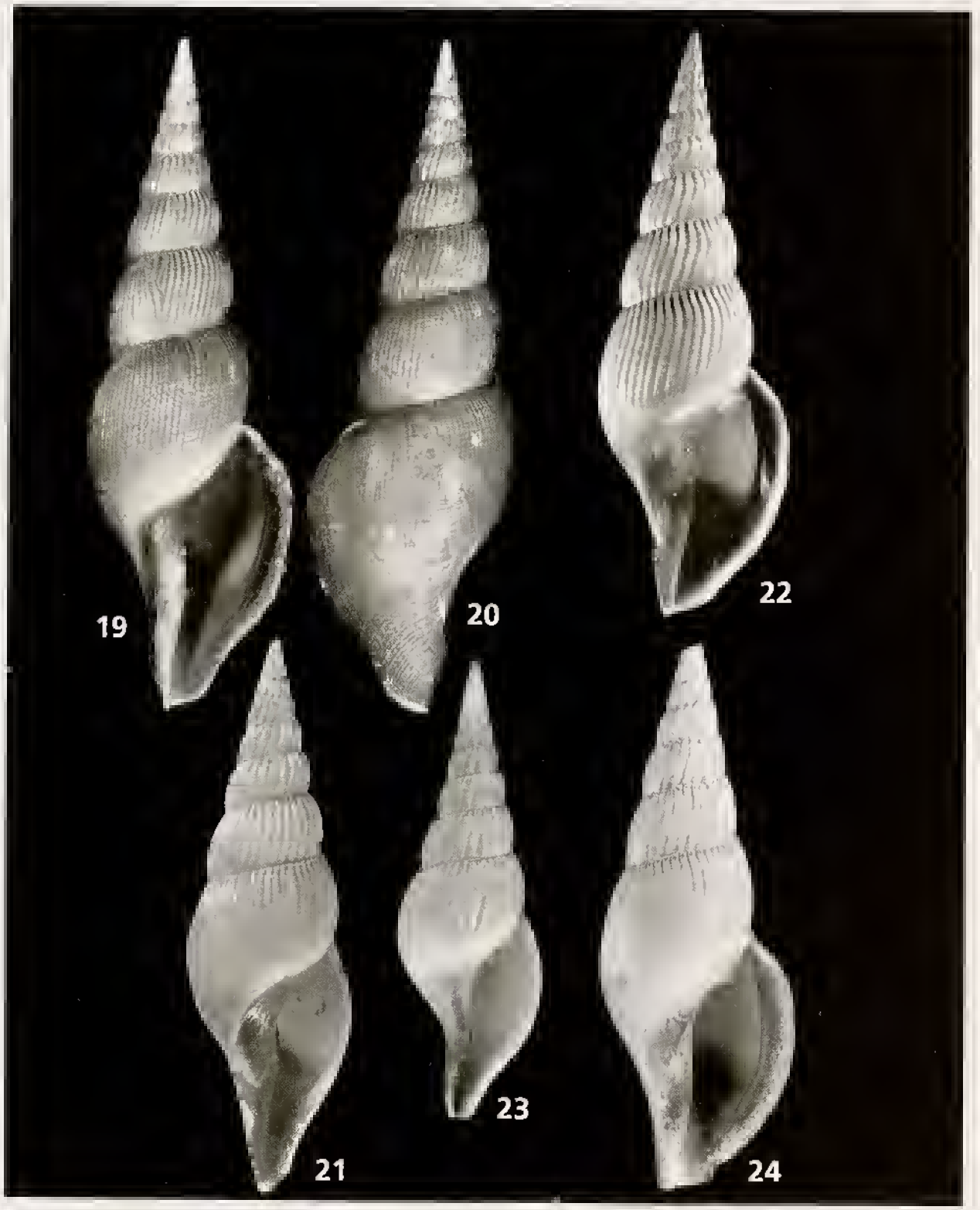
DESCRIPTION. — (Holotype). Shell fusiform, slender, glossy, consisting of 12.5+ whorls (uppermost part, probably the protoconch and one teleoconch whorl, missing); last adult whorl occupying 55% of total shell height; adapical teleoconch whorls slightly turreted, remaing whorls regularly convex; suture impressed, slightly channeled. Sculpture consisting of strong, flexuous axial ribs, and much fainter spiral groves from the 5th whorl onwards, resulting in a distinct finely clathrate sculpture on last adult whorl. Axial ribs sharp, comparatively stronger and fewer (16 on 6th whorl) on spire whorls, more numerous (59 on penultimate, 90 on last adult whorl) and lower on adult whorls; ribs extending to behind peristome, fading in abapical part of last adult whorl, below periphery. Thin but distinct incremental lines. Spiral sculpture consisting on spire whorls of simple incised lines, on last 3 whorls of broader groves (27 on penultimate whorl) forming gentle undulations at their intersection with axial ribs; on last adult whorl, interspaces between groves forming distinct spiral cords below periphery and on canal. Outer lip thick, flaring; columellar area arched, thinly calloused; siphonal canal broad, distinctly set off, moderately long. Ground colour olive-brown, outer lip, columellar area and base with siphonal canal chocolate brown, inner lip callus semitransparent white. Dimensions: height 126.5 mm, breadth 38.5 mm.

The light brown protoconch consists of ca. one whorl, diameter 1.0 mm, sculptured by slighly irregular spiral threads (Figs 64-65).

REMARKS. — *C. egregium* differs from its congeners by its distinctive spiral sculpture, extending onto the last adult whorl. It somewhat resembles *C. dalli* in the high gloss and channelled suture, but the axial ribs are more numerous at equivalent stages of growth, and the suture is distinctly less channeled. Some worn specimens, e.g. the shell from the Kermadecs, are superficially similar to *C. piersonorum*, but differ by the less convex whorls, more numerous, hence narrower, axial ribs, and darker ground colour.

All larger specimens have scars and repairs following attacks by crustaceans and many of the specimens are juveniles and/or worn adults or subadults.

Source : MNHN, Paris



FIGS 19-24. — *Calliotectum egregium*. **19-20,** holotype, New Caledonia, BATHUS 3; stn CP 767, 126.5 mm. — **21,** New Caledonia, MUSORSTOM 4; stn DC 168, subadult, 76 mm. — **22,** New Caledonia; BATHUS 3; stn CP 844, small adult with thickened lip, 70.5 mm. — **23,** Wallis, MUSORSTOM 7; stn CP 552, juvenile, 47 mm. — **24,** Kermadec, NZOI stn P946, 75 mm.

Source : MNHN, Paris

Calliotectum fischeri Olsson, 1964

Calliotectum fischeri Olsson, 1964: 129, pl. 23 fig. 4

TYPE MATERIAL. — Holotype USNM 643941 (not seen).

TYPE LOCALITY. — Quebrada Camerones, Esmeraldas Province, Ecuador; Pliocene.

REMARKS. — We have not examined material of this species, which beside the holotype is known only from a few fragments from the type locality, one of which is figured by EMERSON & SAGE (1986). *C. fischeri* is characterized by its broad profile, with low shouldered whorls, sculptured by densely packed sigmoid axial ribs.

Calliotectum marci (Koperberg, 1931)

Figs 25-27

Borsonia marci Koperberg, 1931: 45, pl. 1 figs 9-10.
B. marci fatuensis Koperberg, 1931: 45, pl. 1, fig. 9.
B. marci fekuensis Koperberg, 1931: 46, pl. 1, fig. 10.

TYPE MATERIAL. — 3 syntypes in the Mineralogisch-Geologisch Museum, University of Technology, Delft, Netherlands, reg. number KA-13960-13962.

TYPE LOCALITY. — Nono Fatoe Fekoe, Timor, Indonesia; Pliocene.

MATERIAL EXAMINED. — The type material.

REMARKS. — When *Calliotectum marci* was described in the turrid genus *Borsonia*, KOPERBERG had before her 3 juvenile specimens, but nevertheless succeeded to introduce 3 nominal taxa. She divided *B. marci* into two subspecies, but failed to retain the nominal *marci* for any of the two.

ROBBA *et al.* (1989: 83, pl. 2, fig. 8) reported a 30 mm high fragment of a *Teramachia* species from a lower Pleistocene deposit at Tinu, West Timor. They identified it as *T. johnsoni* [= *Calliotectum tibiaeforme*] and noticed that *Borsonia marci* was "strikingly similar", but did not formally synonymize the two nominal taxa, pending examination of Koperberg's type material. We agree that the juvenile type specimens of *C. marci* resemble juveniles of *C. tibiaeforme* more than any other Recent *Calliotectum* species, but we think that a critical evaluation of the name *marci* should ideally be based on adult or subadult specimens from the type locality or other similar deposits in Timor. From a nomenclatural point of view, it must be noted that *Borsonia marci* (11 November 1931) has 19 days priority over *Teramachia tibiaeformis* (November 1931, hence deemed to be 30 November 1931).

Calliotectum mirabile (Clench & Aguayo, 1941)

Howellia mirabilis Clench & Aguayo, 1941: 177, pl. 14, fig. 2.

TYPE MATERIAL. — Holotype MCZ 135291.

TYPE LOCALITY. — Off Matanzas, Cuba. *"Atlantis"* stn 3483, 23°12' N, 81°23' W, 520 m.

DISTRIBUTION. — Beside the holotype, *C. mirabile* is known from only one shell collected crabbed on the Little Bahama Bank in 465 m (EMERSON & SAGE, 1986).

Source : MNHN, Paris

FIGS 25-35. — Fossil *Calliotectum*. — **25-27**, *C. marci*, syntypes, Pliocene of Timor, 28 mm (25-26) and 37 mm (27). — **28-29**, *C. pectinatum*, Neogene of Buton, syntype RMNH 42498, 84 mm. — **30**, *C. pectinatum*, paratype of *Fusus perinusitatus* RMNH 42500. Neogene of Buton, 49 mm. — **31**, *C. shinzatoense*, holotype, Pliocene of Okinawa, 69.4 mm. — **32-33**, *C. waitaraense*, holotype. Miocene of New Zealand, 45.6 mm. – **34-35**, *C. waitaraense*, Miocene of New Zealand, NZGS locality 4784, 20.6 and 19.6 mm.

Source : MNHN, Paris

REMARKS. — We have not examined material of this species and refer to EMERSON & SAGE (1986) for description, illustration and comparative remarks. *C. mirabile* reaches 93 mm in shell length.

Calliotectum pectinatum (Martin, 1933)

Figs 16-18, 28-30

Fusus (Butonius) pectinatus Martin, 1933: 23, pl. 3, figs 20-20a.

Synonym:

Fusinus (Butonius) perinusitatus Beets, 1942: 284, pl. 28, figs 70-72. **(syn. nov.)**

Other references:

Fusus (Butonius) pectinatus – MARTIN, 1935: 111.
Fusinus (Butonius) pectinatus — BEETS, 1942: 284, pl. 28, fig. 69; 1953: 247.

TYPE MATERIAL. — *F. pectinatus*: 2 syntypes RMNH 15217, 42498. – *F. perinusitatus*: holotype RMNH 42499, paratype RMNH 42500.

TYPE LOCALITY. — *F. pectinatus* and *F. perinusitatus*: asphaltic sands of Kabungka, Buton Island, Indonesia.

MATERIAL EXAMINED. — The type material.

DISTRIBUTION. — Asphaltic sands of Kabungka and Waisiu, Buton Island, Indonesia.

REMARKS. — When MARTIN (1933) and BEETS (1942) named the two nominal species of *Butonius*, the asphaltic deposits of Buton were then believed to be of Upper Oligocene age. However, BEETS (1953) later reconsidered the problem and concluded instead that the deposits dated from Upper Miocene to Pliocene and corresponded to a deep-water fauna.

BEETS cited a stronger spiral sculpture and less calloused outer lip as characteristics differentiating *F. pectinatus* from *F. perinusitatus*, but we failed to recognize two species among the four specimens examined. In fact, BEETS had already noted that "*F. perinusitatus* might prove to be synonymous with *F. pectinatus* when more material becomes available".

Calliotectum pectinatum comes very close to *C. dalli* and they may be conspecific (in which case *C. pectinatum* is the oldest name). BEETS (1953) cited several Recent deep-sea species among the fauna from the asphaltic sands of Buton. *Calliotectum pectinatum* and *C. dalli* share a deeply channeled suture, an axial sculpture of broad and high ribs separated by deep grooves, and fine spiral sculpture on the last adult whorl. *C. pectinatum* has similar general proportions to *C. dalli claydoni*, but its shell is heavier, with a more strongly calloused outer lip and stronger axial sculpture. Whereas there is little doubt that *C. pectinatum* is the immediate predecessor of *C. dalli*, we prefer to keep different names for the Upper Miocene-Pliocene and Recent forms. This view should be reevaluated if additional fossil material falls within the range of variation of Recent *C. dalli*, or alternatively if Recent populations of *C. dalli* are discovered that have strongly built and heavy shells as in *C. pectinatum*.

Calliotectum piersonorum sp. nov.

Figs 7, 36-39, 66-67

TYPE MATERIAL. — Holotype and 2 paratypes MNHN.

TYPE LOCALITY. — BIOCAL, stn DW 51, 23°05' S, 165°45' E, 680-700 m, South of New Caledonia.

Source : MNHN, Paris

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 355, 19°37′ N, 158°44′ E, 580 m, 1 dd.
New Caledonia. BIOCAL: stn DW 33, 23°10′ S, 167°10′ E, 675-680 m, 1 worn adult, 5 juv. — Stn DW 51, 23°05′ S, 165°45′ E, 680-700 m, 1 lv. 1 dd (holotype). 3 fragm. — Stn CP 52, 23°36′ S, 167°47′ E, 540-600 m, 1 dd.
MUSORSTOM 4: stn DW 220, 22°58′ S, 167°38′ E, 505-550 m, 1 lv. — Stn DW 223, 22°57′ S, 167°30′ E, 545-560 m, 1 dd. — Stn CP 215, 22°56′ S, 167°17′ E, 485-520 m, 1 dd.
SMIB 1: stn DW 7, 22°56′ S, 167°16′ E, 500 m, 1 dd.
SMIB 2: stn DW 17, 22°55′ S, 167°15′ E, 448 m, 2 dd (paratypes).
SMIB 4: stn DW 61, 23°00′ S, 167°22′ E, 520-550 m, 1 broken dd.

DISTRIBUTION. — Chesterfields and Norfolk Ridge, shells in 450-700 m, alive in 550-680 m.

DESCRIPTION. — (Holotype). Shell solid, porcellaneous, fusiform consisting of one protoconch and 8.3 teleoconch whorls. Protoconch smooth, white, diameter 1.3 mm. First three teleoconch whorls turreted, remaining whorls convex with adpressed, but slightly channelled, suture. Last adult whorl occupying 58% of total shell height. Sculpture consisting of strong, broad axial ribs, rather rounded in section; they number 24 on the penultimate, and 26 on the last adult whorl, where they become obsolete abapically. Aperture ovate, with flaring convex outer lip. Siphonal canal short. Ground colour creamy white; suture, columellar region, base and outer lip purplish brown. Dimensions: height 59.0 mm, breath 19.5 mm.
Largest paratype 96 mm high.

REMARKS. — *C. piersonorum* differs from its congeners by its smaller adult size, absence of spiral sculpture, its axial sculpture extending on the last adult whorl, and colour pattern. It has a superficial resemblance to the Japanese form of *C. tibiaeforme*, but in the latter the last two whorls are smooth, and there is a much darker subsutural band. The protoconch is larger than in the other species of *Calliotectum* where it has been observed (1.3 vs 1.0 mm).

The specific epithet honors Dr and Mrs PIERSON of Nouméa, longtime collectors of New Caledonian shells, and authors of *Porcelaines mystérieuses de Nouvelle-Calédonie*.

Calliotectum shinzatoense (MacNeil, 1961)

Fig. 31

Teramachia shinzatoensis MacNeil, 1961: 96, pl. 9, fig. 1.

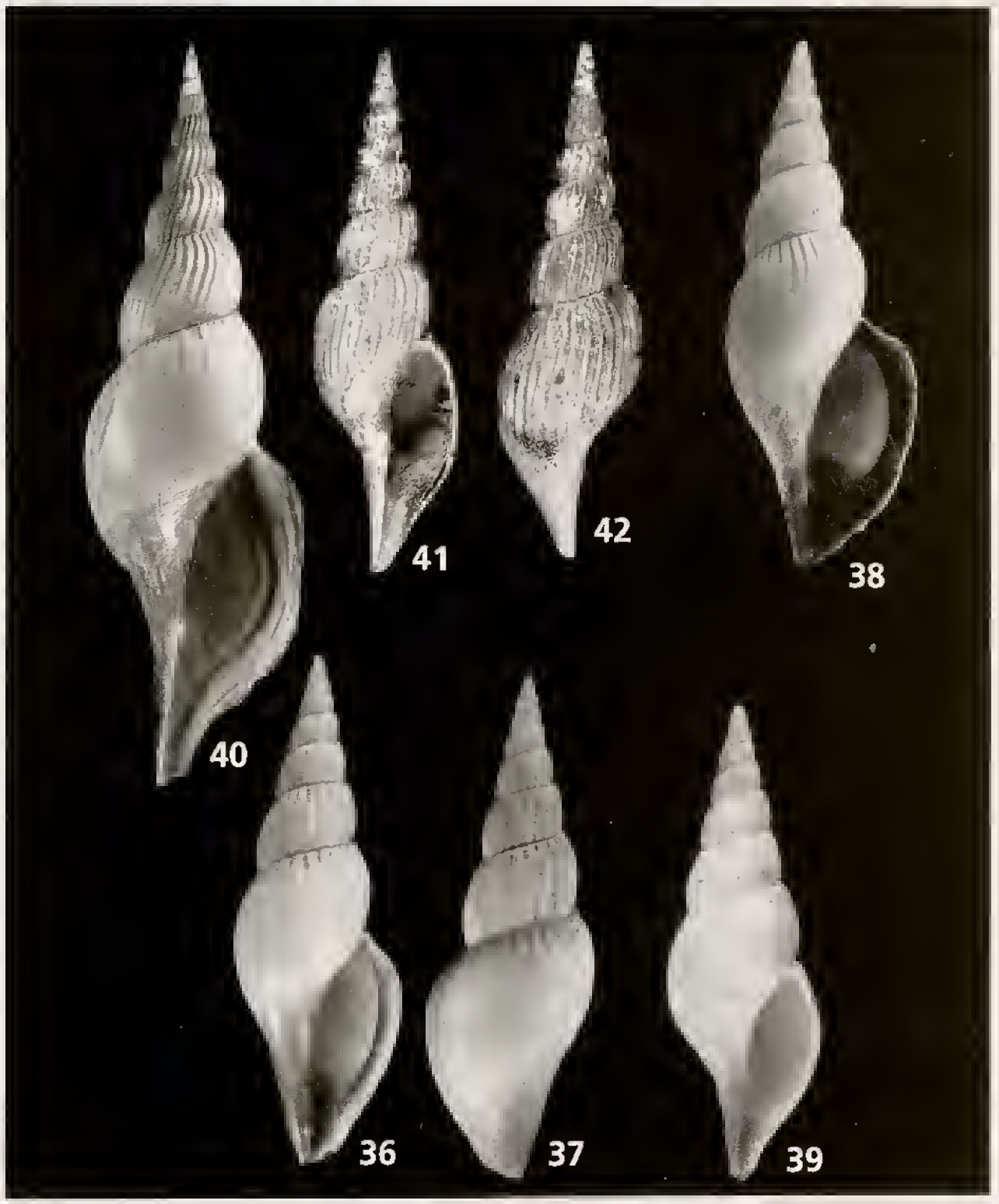
TYPE MATERIAL. — Holotype USNM 562840.

TYPE LOCALITY. — About 0.3 miles [= ca. 0.5 km] south of Shinzato, Okinawa, Japan; Pliocene.

MATERIAL EXAMINED. — The holotype.

REMARKS. — NODA (1980: pl. 5, figs 23, 26, 27; 1988: pl. 10, figs 5, 6, 18) recorded numerous specimens (at least 12) from the same geological formation on Okinawa, but identified them as *Teramachia johnsoni*, noting that *T. shinzatoensis* differs "in having 18-19 axial ribs and smooth surface on penultimate to body whorls". However, we find it questionable that *Calliotectum shinzatoense* represents a distinct species, as the characters of the holotype appear to fall within the range of variation of *C. tibiaeforme*. When he named *Teramachia shinzatoensis*, MACNEIL (1961: 18) attributed the fauna of the Shinzato formation to "very late Miocene or early Pliocene" but, based on evidence from planctonic Foraminifera, NODA (1980: 7) gave an Upper Pliocene age. He also reported that 23.7% of the gastropods from the Shinzato Formation still occur in Recent faunas (NODA, 1980: 6). *C. shinzatoense* may be a synonym of *C. tibiaeforme* and/or *C. marci*.

Source : MNHN, Paris



FIGS 36-42. — *Calliotectum*. **36-37**, *C. piersonorum*, holotype, New Caledonia, BIOCAL: stn DW51, 59 mm. — **38**, *C. piersonorum*, paratype, New Caledonia, SMIB 2: stn DW17, 96 mm. — **39**, *C. piersonorum*, New Caledonia, MUSORSTOM 4: stn DW 223, 37 mm. — **40**, *C. smithi*, Philippines, between Bohol and Cebu, 157 mm. — **41-42**, *C. smithi*, Philippines, MUSORSTOM 3: stn CP128, juvenile, 52 mm.

Source : MNHN, Paris

Calliotectum smithi (Bartsch, 1942)

Figs 40-42

Prodallia smithi Bartsch, 1942: 11-12, pl. 2, fig. 5.

TYPE MATERIAL. — Holotype USNM 231760.

TYPE LOCALITY. — *"Albatross"* stn 5528, off Balicasag, Bohol, 803 m.

MATERIAL EXAMINED. — *"Albatross"* stn 5124, off Maestre de Campo Island, 515 m, 1 paratype (USNM 235394).
Philippines. MUSORSTOM 2: stn CP 46, 13°26′ N, 122°17′ E, 445-520 m, Lubang Island, 1 dd. MUSORSTOM 3: stn CP 122, 12°20′ N, 121°42′ E, 673-675 m, SW of Mindoro, 2 juv. dd. — Stn CP 128, 11°50′ N, 121° 42′ E, 815-821 m, S of Mindoro, 2 juv. dd. — Stn CP 135, 11°58′ N, 122°02′ E, 486-551 m, W of Panay, 1 lv, 1 dd (all MNHN).
Off southern Mindanao (Coll. Doutć, Bail, Goto), 7 shells.

DISTRIBUTION. — Philippine Islands, alive in 486-551 m, shells to 815 m.

REMARKS. — *C. smithi*, formerly very rare, is now regularly caught alive in tangle nets by fishermen. The shells are purple brown with a pale zone on the lower half of the last whorl. The apex is lighter in colour.

For distinguishing characters from *C. tibiaeforme*, see that species.

Callioteetum tibiaeforme (Kuroda, 1931)

Figs 8-9, 43-56

Teramachia tibiaeformis Kuroda, 1931: 45, figs 2, 3.

Synonyms:

Prodallia johnsoni Bartsch, 1942: 12, pl. 2, fig. 3. **(syn. nov.)**
Teramachia johnsoni williamsorum Rehder, 1972: 7-10, figs 1-7.
Teramachia dupreyae Emerson, 1985: 102-107.

TYPE MATERIAL. — *Teramachia tibiaeformis*: holotype in the Teramachi collection (whereabouts unknown). — *Prodallia johnsoni*: holotype USNM 238419. — *Teramachia johnsoni williamsorum*: holotype USNM 707229. — *T. dupreyae*: holotype AMNH 213477.

TYPE LOCALITY. — *Teramachia tibiaeformis*: off Kii, Japan, depth unknown. — *Prodallia johnsoni*: *"Albatross"* stn 5424, off Cagayan I., Sulu Sea, 620 m. — *Teramachia johnsoni williamsorum*: off Tung-Chiang, Taiwan, in 50-275 m. — *T. dupreyae*: 200 miles NW of Broome, Western Australia, off McDonnell Reef, 400 m.

DISTRIBUTION. — From Southern Japan to off Southwestern Australia and the tropical South West Pacific. Reported from the Upper Pliocene Shinzato Formation of Okinawa (NODA, 1980, 1988).

REMARKS. — Our concept of *C. tibiaeforme* differs markedly from that of our predecessors: we consider the Japanese topotypical populations as the northernmost extension of the range of a variable species known to the South as *Teramachia johnsoni* and *T. dupreyae*. As long as they were known only from disjunct populations in Japan and the Philippines, the distinction between *T.*

Source : MNHN, Paris

tibiaeforme and *T. johnsoni* appeared clear-cut, and recognition at species level warranted. Later, populations from Taiwan and NW Australia became known, each with characteristics that were the basis for the naming of *T. johnsoni williamsorum* and *T. dupreyae* respectively. Admittedly, groups of populations are morphologically recognizable on a geographical basis (Poppe & Goto, 1992), and it may be tempting to treat them as subspecies. However, giving a formal name to every group of populations is untenable, as still more populations from intermediate or adjacent areas are discovered. We believe that the reason why the named forms are presently partly disjunct is because inadequate sampling has been done in intermediate areas (Indonesia, New Guinea). Consequently, we interpret all these populations as geographical variants of a single species, and recommend avoidance of the use of subspecies to designate discrete groups of populations.

C. tibiaeforme is extremely variable in shape, sculpture and colouration. There exist slender, almost fusiform shells (Philippines), as well as specimens with broad last adult whorl and expanded outer lip (Western Australia). Axial rib counts vary between 30 (Taiwan) and 42 (NW Australia) on the first whorls. The ribs may extend to the last adult whorl (New Caledonia) or be restricted to the earlier teleoconch whorls (Japan). The colour varies from white (W Australia) to violet brown (Taiwan). A dark subsutural band and/or a darker zone near the siphonal canal may be present. Against this variation, a constant character is the characteristic sculpture of flexuous axial ribs crossed by strong spiral cords on the spire whorls (Figs 54-56).

C. tibiaeforme is nearest to *C. smithi*. The constant specific characters are: (1) the adpressed suture in *C. tibiaeforme* vs. impressed in *smithi*; (2) axial ribs on mid teleoconch whorls with square section vs. triangular section in *smithi*; (3) a dark subsutural band is present in most populations; the only exception is off SW Australia, at the extremity of the range, where the sutural area nevertheless has a dark tinge. Protoconchs consist of about one whorl, diameter ca. 1.0 mm, light brown, with a sculpture of fine spiral lines. Other distinguishing characters vary between populations, as reviewed below.

From a nomenclatural point of view, it must be noted that *Calliotectum marci* (published 11 November 1931) may be a senior synonym of *C. tibiaeforme* (published November 1931, hence deemed to be 30 November 1931); see Remarks under *C. marci*.

Japan form

Figs 43-45

Records and material examined. — **Japan**. Southern Honshu and southwards, 150-500 m (Kira, 1962; Higo & Goto, 1993). – From southern Japan (Coll. Doute, Bail, Goto), 4 shs. — Off Tosa, 180-270 m, 3 lv, 1 dd (LACM 35052, 67093-094). — Off Mikawa, deep water, 1 lv (MNHN).

Remarks. — The Japan form differs by its small adult size (63-93 mm), its thick, heavy shell, with fewer axial ribs on earlier whorls, and very short siphonal canal. The base colour varies from pale cream brown to light lilac, with distinct darker subsutural band.

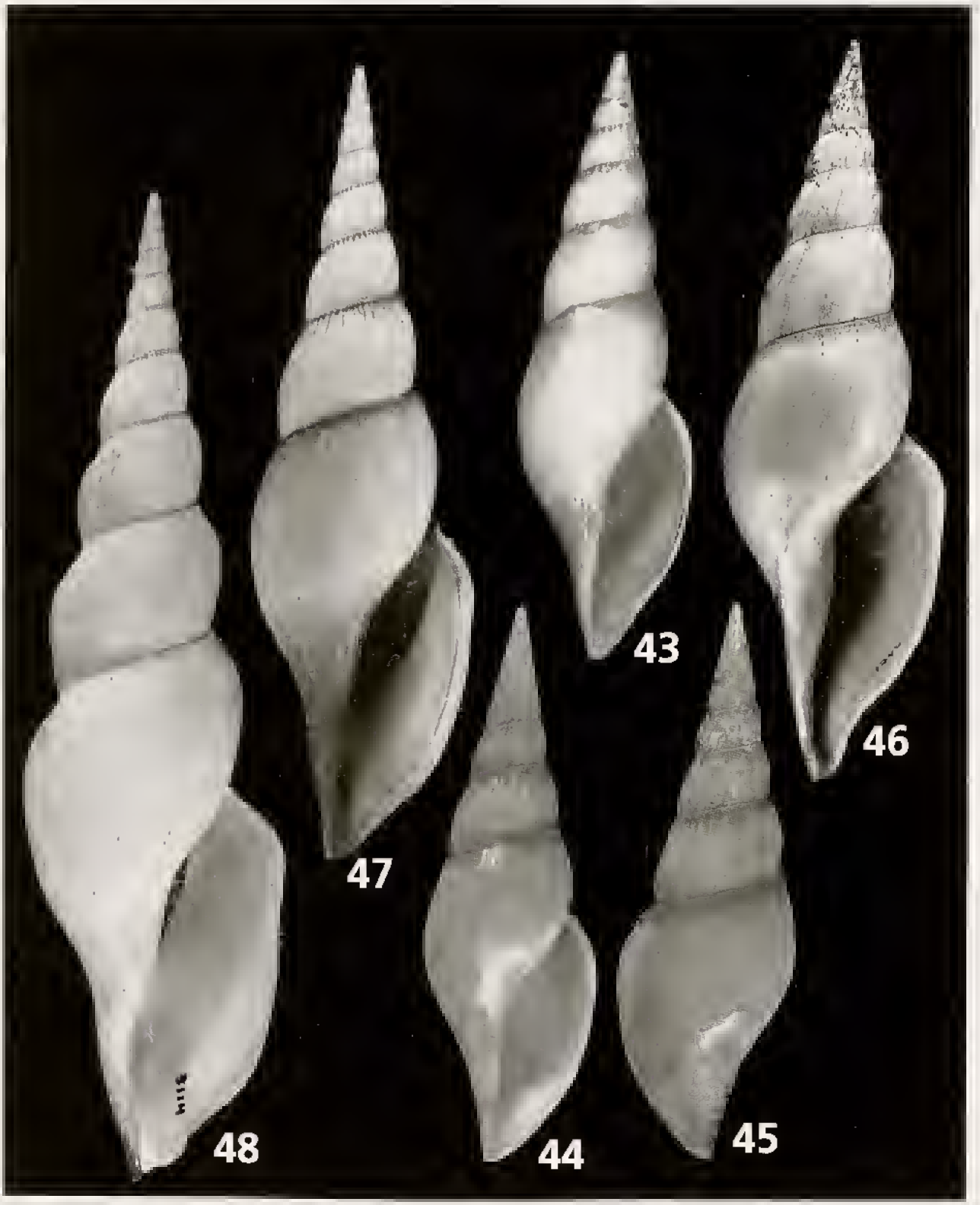
Most Japanese *C. tibiaeforme* in Western collections appear to have been taken in the late 1950s and 1960s. We have seen no recently taken material, but this apparently reflects changes in the Japanese shell market rather than actual changes in abundance of the species.

Taiwan form

Fig. 46

Material examined. — "Off Taiwan", 6 specimens obtained through shells dealers from fishing boats operating from Kaoshiung (Coll. Doute, Bail, Poppe).

Source : MNHN, Paris



FIGS 43-48. — *Calliotectum tibiaeforme*. — **43**, Japan, 94 mm. — **44-45**, off Mikawa, Japan, 62.5 mm. — **46**, off S.Taiwan, 250 m, 132 mm. — **47**, Arafura Sea, 145 mm. — **48**, off Western Australia, form *dupreyae*, 206 mm.

Source : MNHN, Paris

REMARKS. — The Taiwan form is 121-134 mm high, thus much larger than the Japan form. It differs by a broader shell from the similarly coloured (purplish-grey with olive grey periostracum) Philippines specimens. This is the population named *Teramachia johnsoni williamsorum*.

LAN (1979) figured a shell as *Teramachia tibiaeformis*. He stated that it was seasonally available in waters between 200 and 400 m deep. All Taiwan specimens in Western collections have been trawled in the beginning of the 1970s.

Philippines form

Figs 55-56

RECORDS AND MATERIAL EXAMINED. — *"Albatross"* stn 5424, off Cagayan Island, Sulu Sea, 620 m, holotype. — Stn 5535, off Dumaguete, 570 m, 1 lv (REHDER, 1972). — Southern Mindanao, 8 shs (Coll. Doute, Bail, Goto).
MUSORSTOM 2: stn CP 78, 13°49′ N, 120°28′ E, 441-550 m, off NW Mindoro, 2 juv. dd (MNHN).
MUSORSTOM 3: stn CP 128, 11°50′ N, 121°42′ E, off S Mindoro, 815-821 m, 1 juv. dd (MNHN).

REMARKS. — The Philippines form is 109-140 mm high. It is similar to the Taiwan form in colour (purplish-grey with olive grey periostracum), and differs only by being more slender. This is the population named *Teramachia johnsoni*.

Large numbers of specimens have been taken by tangle nets in the central Philippines, and this is the population most frequently illustrated in popular periodicals and books (*e.g.*, OKUTANI, 1983; SPRINGSTEEN & LEOBRERA, 1986).

Arafura Sea form

Fig. 47

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn CP 9, 05°23′ S, 132°29′ E, 368-389 m, 1 dd. — Stn CP 25, 05°30′ S, 132°52′ E, 336-346 m, 1 dd. — Stn CC 48, 08°19′ S, 132°02′ E, 457-461 m, 1 dd. — Stn CP 59, 08°20′ S, 132°11′ E, 399-405 m, 1 lv. — Stn CP 70, 08°41′ S, 131°47′ E, 410-413 m, 1 dd. — Stn CP 83, 09°23′ S, 131°00′ E, 285-297 m, 1 lv (all MNHN).
Australia. 12 specimens "from the Arafura Sea" obtained through Australian shell dealers (Coll. Doute, Bail, Goto).

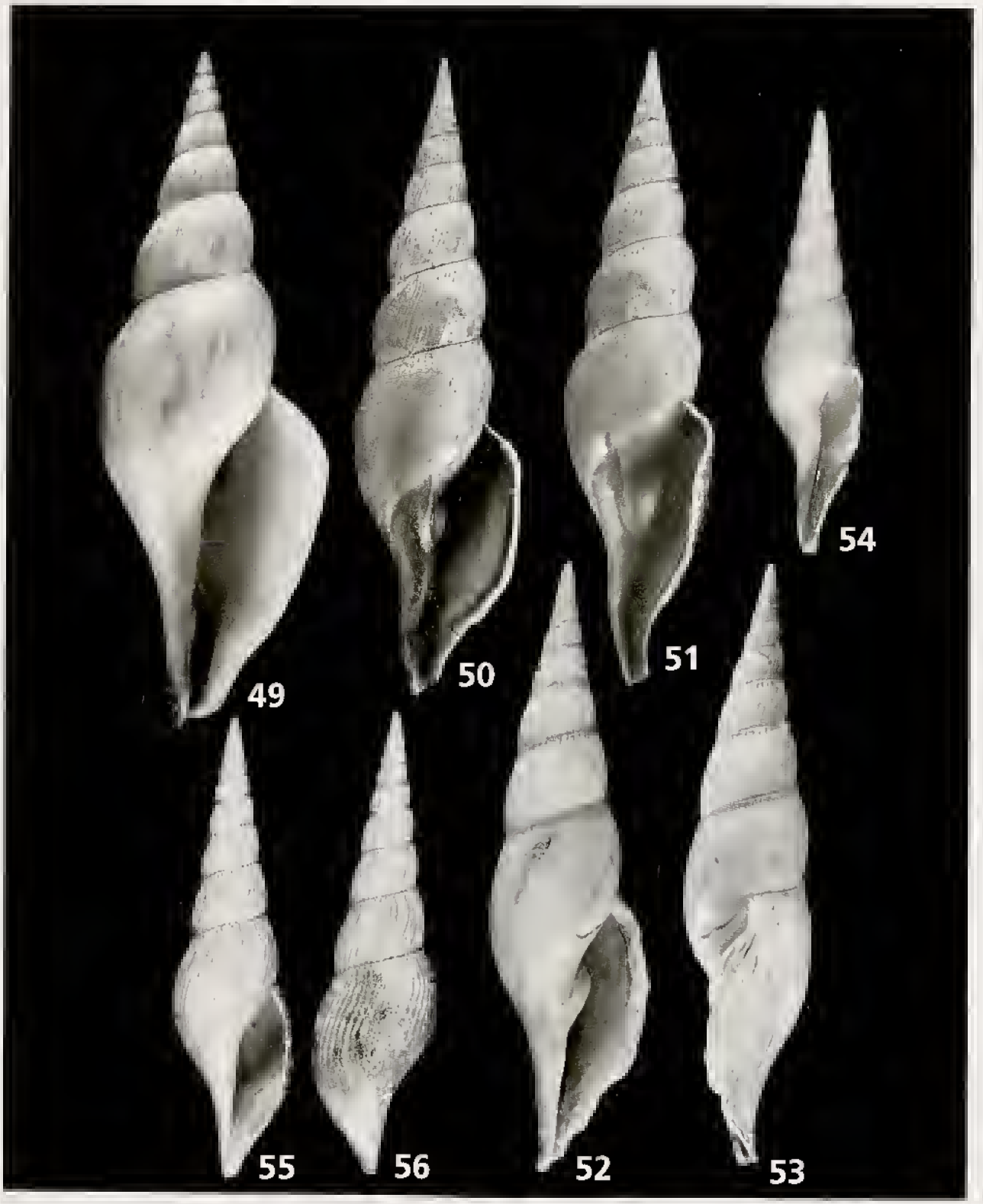
REMARKS. — Shells reach 144 mm in height and are most similar to those from Taiwan, but differ by having more numerous axial ribs, which extend to the penultimate and last adult whorls. Shell colour is quite variable, ranging from white to chocolate brown to lilac, or a mixture of these colours even in a single shell. This form has not received a formal name.

Northwest Australia form

Fig. 48

RECORDS AND MATERIAL EXAMINED. — Continental slope off the North West Shelf from 13°33′ S-122°54′ E to 18°06′ S-118°12′ E in 296 to 504 m (WELLS, 1989). — Off Port Hedland and Broome, 11 specimens (Coll. Doute, Bail, Poppe) from hundreds of specimens examined by the second author in Australia. This population is extensively fished around Scott Reef, NE of Port Hedland, between 170 and 600 m, on soft bottoms.

Source : MNHN, Paris



FIGS 49-56. — *Calliotectum tibiaeforme*. — **49,** off Geraldton, Western Australia, 133 mm. — **50-51,** Vanuatu, MUSORSTOM 8: stn CP 1049, 160 mm. — **52-53,** New Caledonia, MUSORSTOM 4: stn DW 197, 129 mm. — **54,** New Caledonia, MUSORSTOM 6: stn DW 483, juvenile, 58 mm. — **55-56,** Philippines, MUSORSTOM 2: stn CP 78, juvenile, 61 mm.

Source : MNHN, Paris

REMARKS. — Adults of this form are 122-222 mm high, and thus reach the largest size of any population. Their typical white ground colour readily distinguishes them from the Japan, Taiwan, Philippine and Arafura Sea populations. They differ from the Geraldton form by their much higher spire (body whorl: total shell height 48-56%), and fainter spiral striation. This is the population named *Teramachia dupreyae* Emerson, 1985.

Geraldton form

Fig. 49

MATERIAL EXAMINED. — From off Geraldton, Western Australia, 4 specimens (Coll. Douté, Bail, Goto).

REMARKS. — These shells reach only 165 mm, and are thus smaller than large specimens from off the Northwest shelf. They differ from these by their shorter spire (last adult whorl: total shell height 62 %), and by having more widely spaced axial ribs, with stronger spiral striae. They are completely white, except for a discrete brown tinge in the sutural area.

South-West Pacific form

Figs 50-54

MATERIAL EXAMINED (all MNHN). — **New Caledonia**. MUSORSTOM 4: stn DW 197, 18°51′ S, 163°21′ E, 550 m, 1 dd. — Stn CP 242, 22°06′ S, 167°10′ E, 500-550 m, 1 juv. dd.
BATHUS 1: stn DE 696, 20°34′ S, 164°57′ E, 497-520 m, 1 lv. — Stn CP 708, 21°43′ S, 166°39′ E, 550-580 m, 1 juv. dd. — Stn CP 709, 21°42′ S, 166°38′ E, 650-800 m, 1 dd.
BATHUS 2: stn CP 738, 23°02′ S, 166°57′ E, 558-647 m, 1 dd. — Stn CP 762, 22°19′ S, 166°10′ E, 620-700 m, 1 juv. lv.
Loyalty Islands. MUSORSTOM 6: stn CP 466, 21°05′ S, 167°32′ E, 540 m, 1 juv. dd. — Stn DW 483, 21°20′ S, 167°48′ E, 600 m, 1 juv. dd.
Vanuatu. MUSORSTOM 8: stn CP 1047, 16°54′ S, 168°10′ E, 486-494 m, 1 lv. — Stn CP 1049, 16°39′ S, 168°03′ E, 469-525 m, 2 lv. — Stn CP 1054, 16°28′ S, 167°57′ E, 522-527 m, 1 lv. — Stn DW 1072, 15°40′ S, 167°20′ E, 622-625 m, 1 juv. dd. — Stn CP 1124, 15°02′ S, 166°57′ E, 532-599 m, 1 lv.

REMARKS. — The two adults from New Caledonia measure 129 and 151 mm in height, those from Vanuatu 154 and 157 mm. These shells are remarkable by the presence of a callous fold-like development in the columellar region, also discernible in subadults. For several years, we knew a single adult of this form and thought this to be a teratological character. Collection of additional specimens in 1993-94 has forced us to reevaluate this opinion. The material is rather variable in colouration and development of spiral sculpture on the last adult whorl, but it shares with other populations of *C. tibiaeforme* the characteristic sculpture of the spire whorls.

The distribution of this form may extend to North of Fiji, as a one-whorl fragment from Bayonnaise Bank (MUSORSTOM 6: stn DW 626, 11°54′ S, 179°32′ W, 597-600 m) appears to be referable to this species.

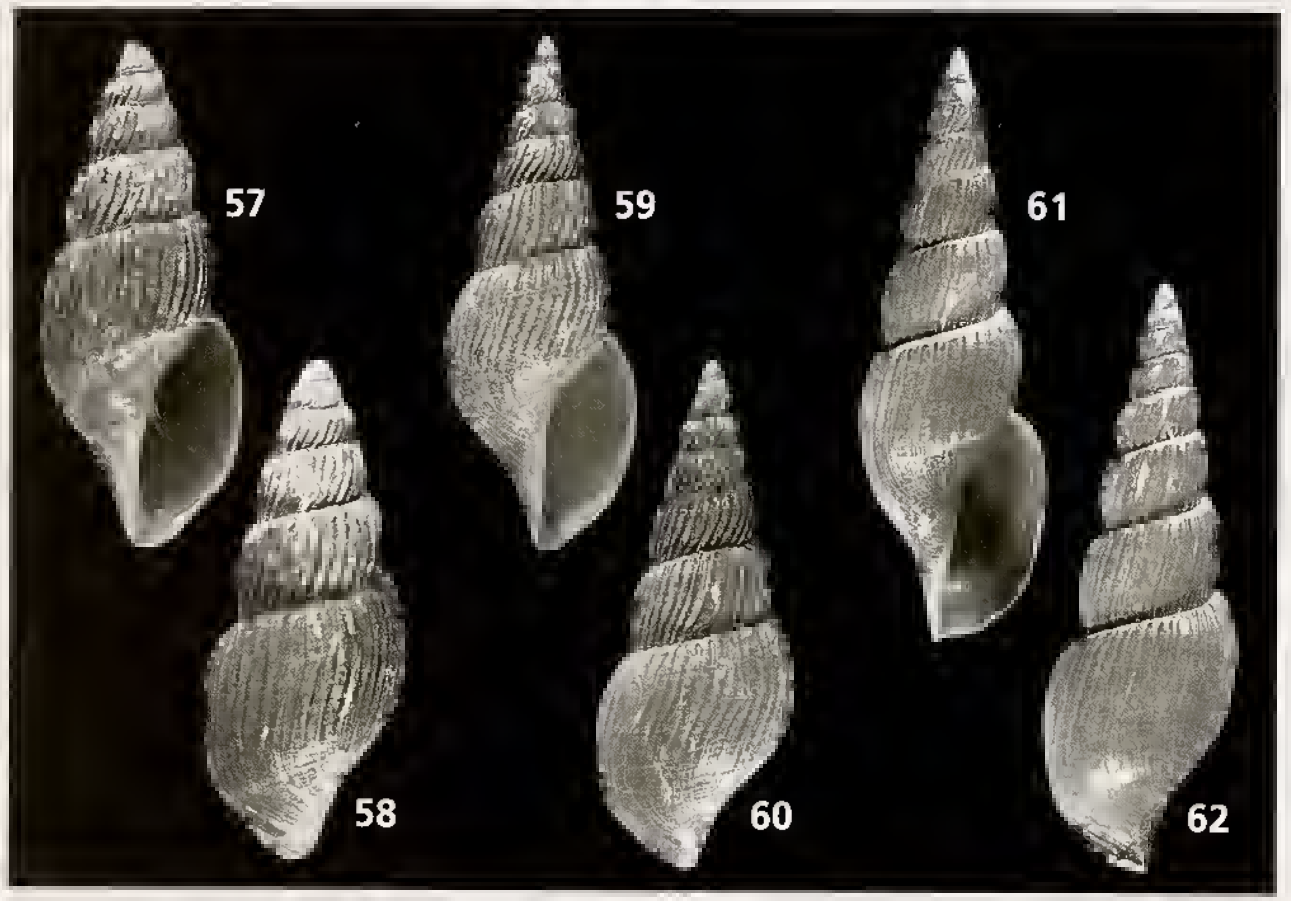
Calliotectum vernicosum Dall, 1890

Figs 1-2, 57-62

Calliotectum vernicosum Dall, 1890: 304, pl. 5, fig. 8.

TYPE MATERIAL. — Lectotype, selected by EMERSON & SAGE (1986: 150, figs 9-10), USNM 96555; 4 paralectotypes, USNM 97068, 633904, DMNH 10135.

Source : MNHN, Paris



FIGS 57-62. — *Calliotectum vernicosum*. — **57-58**, Peru, S of Isla Lobos de Afuera, juvenile, 39 mm. — **59-60**, Ecuador, off Puerto Pizarro, subadult, 62 mm. — **61-62**, Ecuador, Golfo de Guayaquil, 85 mm.

TYPE LOCALITY. — *"Albatross"* stn 2807, 00°24′ S, 89°06′ W, 1485 m, Galapagos Islands (lectotype, 2 paralectotypes). — Stn 2793, 01°03′ N, 80°15′ W, 1355 m, off Ecuador (2 paralectotypes).

MATERIAL EXAMINED. — **Peru**. South of Isla Lobos de Afuera, 07°07′ S, 80°46′ W, 1200 m, leg. McLean & Del Solar, 20 Jan. 1974, 2 lv, 2 dd (LACM 74-9). — about 50 miles [= ca 90 km] SE of Isla Lobos de Afuera, 07°46′ S, 80°31′ W, 800 m, leg. McLean & Del Solar, 23 Jan. 1974, 2 lv, 1 juv. lv (LACM 74-19). — W of Barranca, 10°45.8′ S, 78°36.4′ W, 864 m, leg. Del Solar, 15 May 1971, 1 lv (LACM 71-239).
Ecuador. Gulf of Guayaquil, NW of Tumbes, *"Anton Bruun"* cruise 18B, stn 770, 03°15′ S, 80°55′ W, 945-960 m, 10 Sept. 1966, 1 lv, 2 juv. dd (LACM 66-186). — Off Puerto Pizarro, 13 Apr. 1968, 1 lv (LACM).

DISTRIBUTION. — East Pacific, off Ecuador, Peru and the Galapagos, in 800-1485 m.

REMARKS. — The small size of DALL's holotype (height 48 mm) has masked the close similarities of *Calliotectum vernicosum* with the Indo-Pacific species of *Teramachia*, but these become obvious with the 85 mm adult from the Gulf of Guayaquil. *C. vernicosum* is characterized by its moderately channeled suture, extremely short siphonal canal, thin outer lip, lack of spiral sculpture on spire whorls, and its thick reddish brown periostracum.

Source : MNHN, Paris

Calliotectum waitaraense (Marwick, 1926)

Figs 32-35

Melanopsis waitaraensis Marwick, 1926: 317.

TYPE MATERIAL. — Holotype NZGS TM5902.

TYPE LOCALITY. — NZGS locality 1141, coast south of Waiiti stream mouth, North Taranaki, North Island, New Zealand; late Miocene [Tongaporutuan].

MATERAL EXAMINED. — The holotype. **New Zealand.** NZGS locality 1133, Mimi stream, very near type locality, late Miocene, paratype (NZGS TM5903) and several fragments, representing one or more specimens. — NZGS locality 4784, Marsden-Kumara Rd, Westland, South Island, [Clifdenian] middle Miocene, 12 fragments and young specimens. — NZGS locality 3349, Sawyer's Creek, Boddytown near Greymouth, South Island, middle Miocene, 1 fragment. (All material in NZGS).

REMARKS. — A characteristic of *C. waitaraense* is the sculpture of the juveniles, which have axial ribs constricted adapically, forming a subsutural row of rounded tubercles. Spiral sculpture is variable in the material examined, and no specimen has a complete aperture.

MARWICK (1926) considered *Coptochetus zelandicus* Marshall, 1917 to be congeneric with *Calliotectum waitaraense*, a view accepted by FLEMING (1966), but BEU & MAXWELL (1990) place it with doubt in the genus *Exilia* (Turbinellidae: Ptychatractinae).

DISCUSSION

Calliotectum has been restricted to deep-water since its first recorded occurence, in the Miocene of New Zealand. The unfamiliar faunal assemblages where the fossils are found led to erroneous interpretations by the paleontologists who discovered them. Because the Buton fauna differed so dramatically from known Neogene deposits in Indonesia, MARTIN (1933) and BEETS (1942) initially interpreted it as an Oligocene shallow water fauna, before recognizing it as an Upper Miocene-Pliocene deep water fauna (BEETS, 1953). Similarly, MARWICK (1926) interpreted the North Taranaki deposit with *C. waitaraense* as a brackish water fauna, and placed *Pakaurangia* (= *Calliotectum*) in the family Thiaridae. MACNEIL (1961) appears to have first recognized the similarity of fossil *Calliotectum* (as *Teramachia*) with the modern deep-water taxon. Indeed, *Calliotectum* is an excellent bathymetric marker (BEU & MAXWELL, 1990; NODA, 1980, 1988; ROBBA *et al.*, 1989), although its paleoecological interest is limited by its relative scarcity.

Bathymetric distribution

Altogether, the 7 Recent species of *Calliotectum* have a bathymetric range extending from ca. 150 m to 1650 m, but in the West Pacific-Australia region the majority of records are in the 200-900 m interval. A maximum of three species may occur sympatrically in the same geographical area, and then there is evidence of bathymetric segregation (Fig. 63). Despite partly overlaping depth distribution, there is no instance when two species have been taken alive together in the same haul, thus suggesting that additional factors, such as bottom type and/or hydrological conditions, further contribute to habitat segregation.

Calliotectum dalli has the broadest range of all species, but the extremes are reached in different parts of the geographical range. In fact, both *C. dalli* and *C. tibiaeforme* occur in significantly shallower water in the Arafura Sea than in the Philippines, which was unexpected since the latter are situated at higher latitudes.

Source : MNHN, Paris

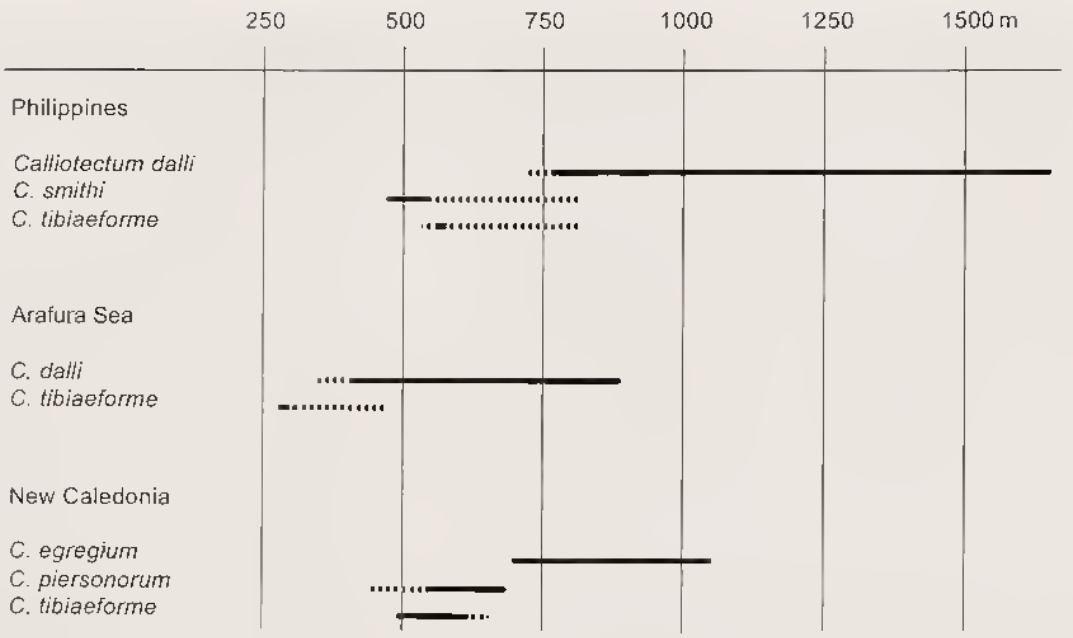


FIG. 63. — Bathymetric distribution of the Indo-Pacific species of *Calliotectum* from discrete geographical regions. Thick line: based on live records; stippled: empty shells or records from shell dealers.

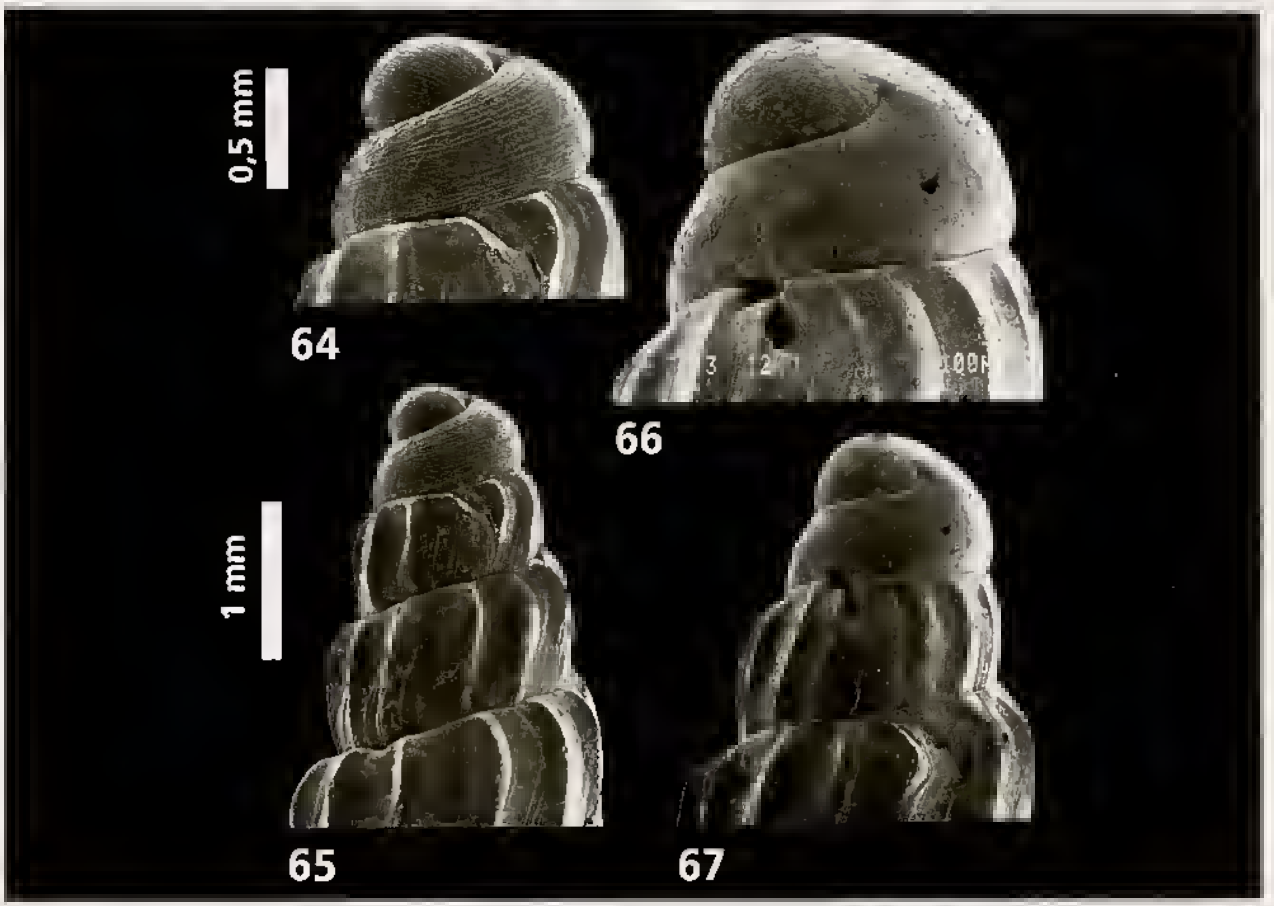
Biogeography

Protoconch morphology indicates non-planktotrophic development (Figs 64-67), but with a diameter in the order of 1 mm, the protoconchs are among the smallest of all Recent volutes. *Calliotectum tibiaeforme* also happens to be the volute with the largest geographical distribution. Also, *C. egregium* is the species that extends the farthest to the East in the Indo-Pacific biogeographical region, on island slopes (Vanuatu, Wallis) that are separated by deep trenches and abyssal plains from populations situated to the West. We suggest that the small size of the postlarva at the time of hatching is compatible with good dispersal capacities that account for extensive horizontal distributions at species level. LEAL & BOUCHET (1991) showed that lecithotrophy is compatible with dispersal over distances of a few hundred kilometers. It is probably significant that *C. piersonorum* has the largest protoconch (1.3 mm) *and* the most restricted range of all Indo-Pacific species.

EMERSON & SAGE (1986) hypothesized that *C. mirabile* is a Pacific plate faunal element carried into the Atlantic on the East Pacific-Caribbean plate in the Eocene (DURHAM, 1985). The fossil record of *Calliotectum* does not extend further back than Pliocene in the East Pacific, and to Miocene in New Zealand. This, of course, does not exclude that Paleogene fossils may one day be discovered. However, if we stick to the available evidence, then the eastwards drift of the East Pacific-Caribbean plate into the Atlantic has happened much too early to have any significance for *Calliotectum* distribution. Instead, the penetration of *Calliotectum* from the East Pacific into the Caribbean through deep passages in Central America until 3 MY ago is compatible with paleontological and tectonic evidence (KEIGWIN, 1982).

If we assume that *Calliotectum* originated in the West Pacific, it remains to explain how it reached the East Pacific. Considering the small size of the protoconch, it cannot even be excluded that *Calliotectum* has a free-swimming, non-feeding, demersal stage between hatching and settlement. This hypothesis is supported by the fact that the protoconch of *C. egregium* is coloured light brown, a character often associated with planctotrophy or demersal non-planctotrophy. We predict that further sampling will reveal the occurence of *Calliotectum* populations as far East as Fiji, Tonga, and perhaps

Source : MNHN, Paris



FIGS 64-67. — Protoconchs and apical whorls of *Calliotectum*. — **64-65**, *C. egregium*, Wallis, MUSORSTOM 7: stn DW 535. — **66-67**, *C. piersonorum*, New Caledonia, BIOCAL: stn DW 33.

the Cook Islands, which are separated from other islands and guyots by distances of less than 600 km (BOUCHET & POPPE, 1988). Further East, in the Central Pacific, distances amount to thousands of kilometers between the Marquesas, Easter Island and Hawaii, and reaching these by dispersal may represent unpassable barriers. Yet, we believe that the most parcimonious hypothesis explaining the occurence of *Calliotectum* in the East Pacific is that of a rare larval dispersal event, followed by speciation.

Catalogue of New Caledonian volutes

The present paper concludes the description of the volute fauna of New Caledonia (BOUCHET, 1979; BOUCHET & POPPE, 1988). A total of 13 species are now known from the area: 4 on the Chesterfield plateau, 11 in New Caledonia proper, and 3 on the Loyalty Ridge. Of 5 shallow water species, 4 are endemic (80%), and of 8 deep-water species, 4 are endemic (50%).

Alcithoe aillaudorum Bouchet & Poppe, 1988; Norfolk Ridge, deep water, endemic
Calliotectum egregium Bouchet & Poppe, 1995; New Caledonia, Loyalty Islands, deep water
C. piersonorum Bouchet & Poppe, 1995; Chesterfield, New Caledonia, deep water, endemic
C. tibiaeforme (Kuroda, 1931); New Caledonia, Loyalty Islands, deep water
Cymbiola deshayesi (Reeve, 1855); Northern New Caledonia, endemic

Source : MNHN, Paris

C. rossiniana (Bernardi, 1859); Southern New Caledonia, endemic
Cymbiolacca thatcheri (McCoy, 1868); Chesterfield, endemic
Lyria deliciosa (Montrouzier, 1859); New Caledonia
L. exorata Bouchet & Poppe, 1988; Chesterfield, deep water, endemic
L. grangei Cernohorsky, 1980; Chesterfield, endemic
L. habei Okutani, 1979; New Caledonia, deep water
L. kuniene Bouchet, 1979; Southern New Caledonia, deep water, endemic
L. planicostata (Sowerby, 1903); New Caledonia, deep water.

ACKNOWLEDGEMENTS

This revision has benefited from the experience and enthusiasm of two dedicated volute collectors: P. Bail (Paris) and H. Douté (Bad Saeckingen, Germany). A.G. Beu (NZGS) and P.A. Maxwell (Waimate, New Zealand) discussed the status of the fossils from New Zealand and drew our attention to the description of *Borsonia marci*. B.A. Marshall (Wellington) arranged the loan of material from NZOI. A. Janssen (RMNH) and C. Maugenest (Mineralogisch-Geologisch Museum, Delft) loaned the types of Martin and Koperberg. J.H. McLean (Los Angeles) allowed us to use the superb material of *Calliotectum vernicosum* he had brought together, and M.G. Harasewych (USNM) offered insights on the supraspecific taxonomy. Finally, we thank A. Warén (Stockholm) for SEM work and P. Lozouet (Paris) for photography.

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Source : MNHN, Paris

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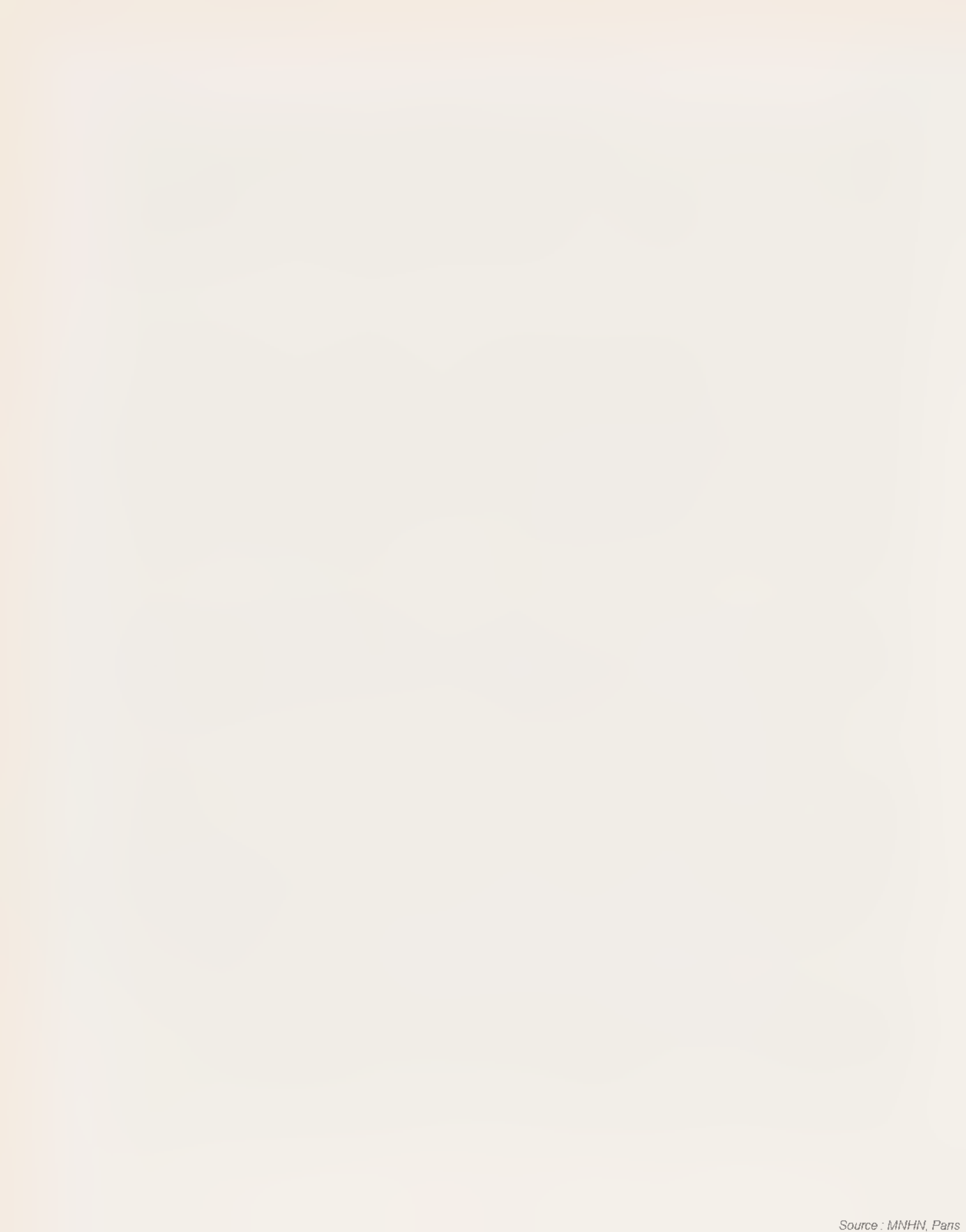
Source : MNHN, Paris



Source : MNHN, Paris

8

A revision of the drilliid genera *Splendrillia* and *Plagiostropha* (Gastropoda: Conoidea) from New Caledonia, with additional records from other areas

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ABSTRACT

Based on specimens from the Muséum National d'Histoire Naturelle, Paris, the drilliid genera *Splendrillia* and *Plagiostropha* from New Caledonia are revised, and information on species of these genera from other areas is included. A total of 18 species of *Splendrillia* are examined. Fourteen species are described as new: one from the Philippines and thirteen from New Caledonia (of which two are also recorded from the Mozambique Channel and one from the Philippines). *Splendrillia disjecta* (Smith, 1888) described from the Persian Gulf, is recorded from the Philippines. *Splendrillia persica* (Smith, 1888), also described from the Persian Gulf is recorded from New Caledonia. *Splendrillia solicitata* (Sowerby, 1913) described from Japan is recorded from New Caledonia. *Splendrillia praeclara* (Melvill, 1893) described from Bombay, India, is recorded from both the Philippines and New Caledonia. Four new species of *Plagiostropha* are described: three from New Caledonia and one from Réunion Island.

RÉSUMÉ

Révision des espèces des genres de Drilliidae *Splendrillia* et *Plagiostropha* (Gastropoda: Conoidea) de Nouvelle-Calédonie, et nouvelles signalisations d'autres régions géographiques.

Les espèces néo-calédoniennes des genres de Drilliidae *Splendrillia* et *Plagiostropha* sont étudiées sur la base des collections du Muséum national d'Histoire naturelle. Des indications nouvelles sur les espèces de ces genres provenant d'autres régions géographiques figurent également dans ce travail. Au total, 18 espèces de *Splendrillia* sont examinées, dont 14 sont

WELLS, F. E., 1995. — A revision of the drilliid genera *Splendrillia* and *Plagiostropha* (Gastropoda, Conoidea) from New Caledonia, with additional records from other areas. *In*: P. BOUCHET (ed.), Résultats des Campagnes MUSORSTOM, Volume 14. *Mém. Mus. natn. Hist. nat.* **167**: 527-556. Paris ISBN 2-85653-217-9.

Published 29th December 1995.

Source : MNHN, Paris

décrites comme nouvelles: une des Philippines et treize de Nouvelle-Calédonie (dont deux sont également connues du Canal du Mozambique et une des Philippines). *Splendrillia disjecta* (Smith, 1888), décrite du Golfe Persique, est recensée des Philippines. *Splendrillia persica* (Smith, 1888), également décrite du Golfe Persique, est signalée de Nouvelle-Calédonie. L'aire de répartition de *Splendrillia solicitata* (Sowerby, 1913), décrite du Japon, est étendue á la Nouvelle-Calédonie. Enfin, *Splendrillia praeclara* (Melvill, 1893), décrite de Bombay en Inde, est recensée des Philippines. Quatre nouvelles espéces de *Plagiostropha* sont décrites: trois de Nouvelle-Calédonie et une de la Réunion.

INTRODUCTION

The conoidean family Turridae *sensu lato* is the largest of all of the molluscan families, with KILBURN (pers. comm.) estimating that there are over 4000 Recent species and BOUCHET (1990) showing that there have been 679 genus group names proposed; TAYLOR *et al.* (1993) recognise 337 Recent genera and subgenera as valid. Over 10,000 nominal Recent and fossil species have been described. Classification at both the species and generic levels within the Turridae has been chaotic, with little recent revisionary work having been done on this vast family. The family level classification has also been controversial, with different authors, especially POWELL (1966), MCLEAN (1971) and BOUCHET & WARÉN (1980) recognizing differing numbers of subfamilies, varying from none to 15. In the last decade some anatomical data have become available, particularly on the structure of the foregut. Recently TAYLOR *et al.* (1993) have brought together the published and previously unpublished anatomical data and have combined them with more traditional data on shell and radular structure to arrive at a tentative new classification of the Conoidea. This has involved a major modification of the concept of the family Turridae, with the family being considerably restricted and some groups being transferred to the Conidae or to other families within an expanded number of families in the Conoidea.

There has never been a complete revision of the Indo-Pacific Turridae. Over 70 years ago HEDLEY (1922) published a revision of the Australian Turridae known at that time, which included many tropical species. POWELL (1964; 1967; 1969) revised Indo-Pacific species of the subfamilies Turrinae and Turriculinae. In a major series of papers KILBURN (1983; 1985; 1986; 1988; 1991; 1992; in press) has been systematically revising the turrids of southern Africa, which include some Indo-Pacific species. KOSUGE (1983; 1985; 1986; 1988a; 1988b; 1992) examined turrids from the continental shelf and slope off northwestern Australia. WELLS (1990; 1991a; 1991b; 1993) has been revising Australian shallow water turrids.

For a number of years ORSTOM and the Muséum National d'Histoire Naturelle, Paris, have been conducting an extensive sampling programme in the Indo-Pacific, particularly in the waters surrounding New Caledonia, but also including sampling in other regions such as the Philippines. A substantial collection of turrids has been developed as a result of the field program, far too complex and large a collection to be reported in a single paper. This paper reports on the drilliid genera *Splendrillia* and *Plagiostropha*. The only substantial papers on these genera in recent decades have been KILBURN (1988) and WELLS (1990). Both genera were included in the family Drilliidae by TAYLOR *et al.* (1993).

MATERIALS AND METHODS

As indicated above, this paper is based primarily on specimens from New Caledonia in the Muséum National d'Histoire Naturelle, Paris. Type material of related species has been borrowed wherever possible from the museum in which it was deposited. Descriptions are based on shells oriented in the traditional way, spire up with the aperture facing the viewer.

Source : MNHN, Paris

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

AMS : Australian Museum, Sydney
BMNH : The Natural History Museum, London
MNHN : Muséum National d'Histoire Naturelle, Paris
NMW : National Museum of Wales, Cardiff
WAM : Western Australian Museum, Perth

Other abbreviations

L : length
W : width
A : length of aperture
lv : live taken specimen
dd : dead collected specimen
OD : Original designation.

SYSTEMATIC ACCOUNT

Family DRILLIIDAE Olsson, 1964

Genus *SPLENDRILLIA* Hedley, 1922

Splendrillia Hedley, 1922: 250. Type species (OD): *Drillia woodsi* Beddome, 1883.

Splendrillia – POWELL, 1942: 99-104. — COTTON, 1947: 11. — LASERON, 1954: 16-17. — POWELL, 1966: 83-84; 1979: 232-234. — KILBURN, 1988: 206-218. — SYSOEV & KANTOR, 1989: 205-214. — WELLS, 1990: 76-100; 1991b: 63-68. — TREW, 1991: 8-9. - TAYLOR *et al.*, 1993: 164.
Elaeocyma (*Splendrillia*) – TSUCHIDA, 1983: 344-346.

DIAGNOSIS. — *Shells* small to medium, 5-30 mm, light to solid, high spired, truncated anterior end. *Protoconch* paucispiral. 2 whorls, usually smooth, rounded to globose. Up to 9 *teleoconch* whorls usually with strong axial ribs, spiral sculpturing absent or restricted to anterior of shell. Pronounced parietal callus in many species. Sinus moderate to deep, outer lip thin to thickened, slight stromboid notch on base of outer lip. Anterior canal short, broad, shallow to strongly notched. Shell white to brown. Operculum oblolanceate, nucleus terminal.

Indo-Pacific and southern Australia; intertidal to ca. 1000 m.

REMARKS. — Both the genera *Splendrillia* and *Plagiostropha* have been recently included in the turrid subfamily Drilliinae (KILBURN 1988; WELLS 1990), but TAYLOR *et al.* (1993) have recently raised the Drilliinae to family level, based largely on anatomical grounds.

As presently construed the genus *Splendrillia* is composed of species grouped together almost entirely on knowledge of their shell features. Aside from the single study of SYSOEV & KANTOR (1989) there have been no examinations of the anatomy of any of the species, and even the structure of the radula and opercula are not known for most species. The genus *Splendrillia* has never been revised in the Indo-West Pacific, though POWELL (1966) included several species in the genus which had previously been placed in *Drillia*. In view of the problems in properly defining the genus it is likely that when, and indeed if, the anatomy becomes known many of the species now considered to belong to *Splendrillia* will be transferred to other genera, perhaps including new genera. With the several

Source : MNHN, Paris

hundred generic names available in the Turridae (BOUCHET 1990) it seems preferable to adopt a broad view of the genus *Splendrillia* rather than erect new genera which might later turn out to be synonyms of genera already proposed.

Splendrillia disjecta (Smith, 1888)

Pl. 1, Figs 1-2; Pl. 2, Figs 1-2

Pleurotoma (Drillia) disjecta Smith, 1888: 308.

Other references:

Drillia disjecta – DAUTZENBERG & BOUGE, 1913: 132.
Splendrillia disjecta – POWELL, 1966: 84.

TYPE MATERIAL. — 4 syntypes BMNH 1874.1.19.31.

TYPE LOCALITY. — "Persian Gulf, China Sea, and Ovalau, Fiji".

MATERIAL EXAMINED. — The type material.
Philippines. MUSORSTOM 2: stn CP 41, 13°46′ N, 122°46′ E, 166-172 m, 4 lv, 2 dd.

DISTRIBUTION. — Persian Gulf to the Philippines. To at least 166 m.

DESCRIPTION. — *Shell* small, 8 mm, high spired, solid. *Protoconch* small, of 2 smooth whorls with microscopic pitting, globose, 0.56 mm wide, 0.45 mm high. *Teleoconch* up to 7 turreted whorls with two prominent convexities in outline. Suture distinct, slightly channeled, nearly straight. Dominant sculpture of axial ribs, which line up on upper whorls. Ribs vertical, narrow, starting as prominent subsutural beads, decreasing, then swelling again at midwhorl, decreasing only slightly to lower whorl, 8 on penultimate whorl, 6-7 on body whorl followed by moderately strong varix, ribs extending well beyond shoulder of body whorl. About 7 distinct spiral cords just above anterior tip of shell. Strong axial growth lines present on body whorl. Outer lip thickened. Sinus very deep, U shaped, directed at a 45° angle to shell axis, posterior margin callused, entrance partially constricted by very strong parietal callus. Aperture moderately broad, subrectangular. Columella narrow, straight, margin distinctly raised. Shell truncate, anterior canal short, broad, deep, anterior tip notched. Shell colour uniform glossy white.

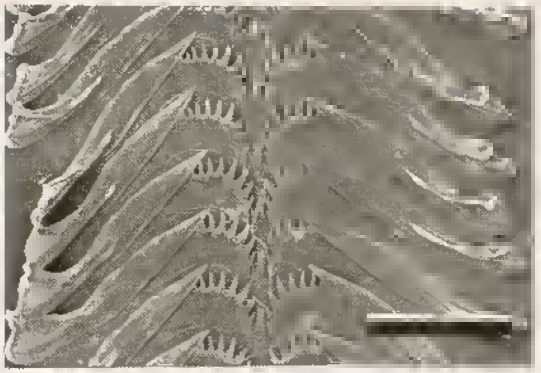
Measurements (mm):

	Length	Width	Aperture	W/L	A/L
BMNH syntypes	7.1	2.4	2.9	0.34	0.41
	7.1	2.3	2.7	0.32	0.38
	7.6	2.4	2.7	0.32	0.36

REMARKS. — *Splendrillia disjecta* is a distinctive species with narrow axial ribs lined up on adjacent whorls. The ribs each have two peaks, one subsutural and a second, larger peak on the lower half of each whorl. The Philippines material is identical to the types in having the same protoconch size and same number of whorls, but the ribs are slightly larger and more rounded. The Philippines shells are more colourful because they were collected alive or soon after death.

Splendrillia disjecta is similar to *S. persica*. The Philippines material of *S. disjecta* consists of fresh shells with plenty of colour which do not at first glance look the same as those of *S. persica*, but the shells are similar in size and number of whorls, and the protoconchs are of the same size. The whorls of *S. persica* are slightly broader than those of *S. disjecta*, and the ribs are also slightly broader, they extend down the face of the body whorl, and the protoconch is of the same size. The absence of a parietal callus is a key difference separating *S. disjecta* from *S. persica*.

Source : MNHN, Paris



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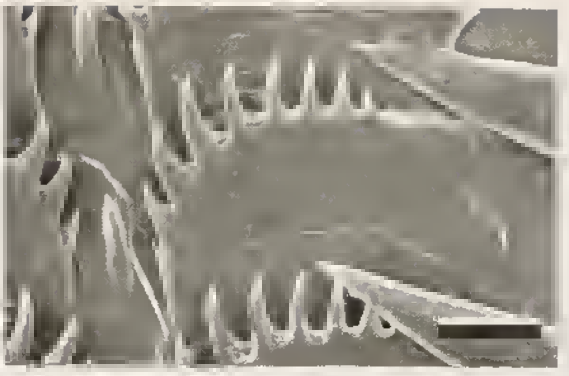

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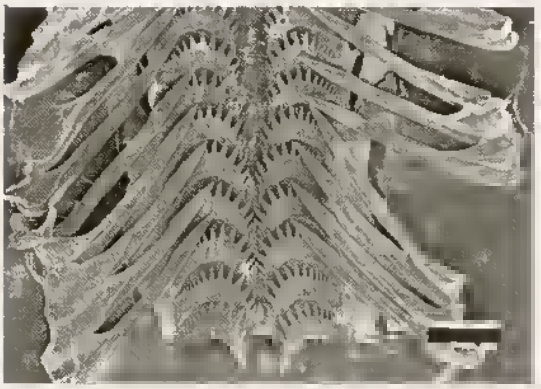

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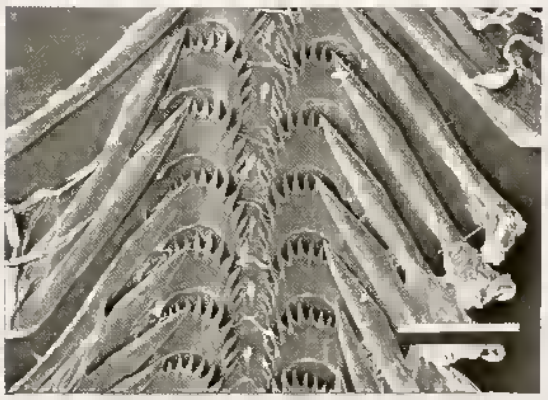

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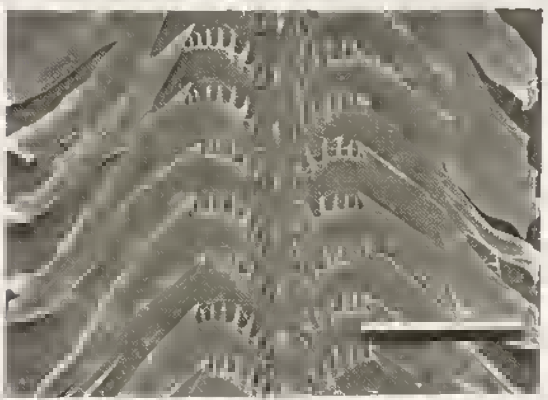

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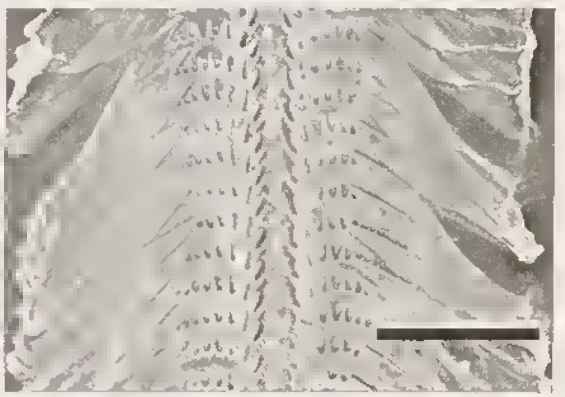

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PLATE 1. Radulae of *Splendrillia*. — **1-2**, *S. disjecta*, Philippines, MUSORSTOM 2: stn CP 41. — **3-4**, *S. solicitata*, Loyalty Islands, MUSORSTOM 6: stn DW 468. — **5-6**, *S. elongata*, Philippines, MUSORSTOM 3: stn CP 106. — **7**, *S. carolae*, New Caledonia, BIOCAL: stn DW 46. — **8**, *S. triconica*, New Caledonia, BIOCAL: stn DW 44. Scale lines: 100 µm (1, 3, 5, 7-8), 20 µm (2, 4, 6).

Source : MNHN, Paris

Splendrillia persica (Smith, 1888)

Pl. 2, Figs 3-4

Pleurotoma persica Smith, 1888: 307.
Drillia persica var. *jacintha* Melvill, 1917: 156, pl. 9, fig 6.

Other references:

Pleurotoma persica – Melvill & Standen, 1901: 429, pl. 21, fig 14.
Splendrillia persica – Powell 1966: 84. — Trew, 1991: 9. — Wells, 1993: 114-116, pl. 1, figs 3-4.
Splendrillia persica var. *jacintha* – Trew, 1991: 9.

Type material. — *P. persica*: 4 syntypes BMNH 1874.1.19.30. — *D. persica* var. *jacintha*: 2 syntypes BMNH 1925.3.12.2.3; 2 syntypes NMW 1955.158.478.

Type locality. — *P. persica*: Persian Gulf; var. *jacintha*: Persian Gulf [defined by Melvill as including the Gulf of Oman, "bordered eastward by long. 59°48′ E"].

Material examined. — The type material.

NW Indian Ocean. Persian Gulf (4 NMW). — Linyah, Persian Gulf (AMS). — Gulf of Oman, 24°58′ N, 56°54′ E, 285 m (NMW). — Charbar, Gulf of Oman, 73 m (AMS). — Henjam I., Iran (3 NMW). — Karachi, Pakistan (AMS). — Bahrain (AMS).

New Caledonia. LAGON: stn 830, Poindimié area, 20°49′ S, 165°19′ E, 105-110 m, 5 dd (MNHN).

Distribution. — Indo-West Pacific; Persian Gulf to New Caledonia in depths of from 73 to 285 m.

Description. — *Shell* medium, to 14 mm, very high spired. *Protoconch* small, of 2 whorls, rounded, slightly globose with very fine microscopic pitting, lower part of whorl with indistinct spiral rib giving outline a triangular appearance, 0.66 mm wide, 0.51 mm high. *Teleoconch* of up to 7 angular whorls, turreted. Suture distinct, slightly impressed, slightly undulating. Sculpture dominated by strong, narrow axial ribs, which form 1/3 way down whorl, reach maximum by midwhorl, continue to lower suture, tending to line up on adjacent whorls, 8-11 on penultimate whorl, 8-11 on body whorl, extend below shoulder of body whorl but not to anterior tip of shell, distinct varix usually present on body whorl, if so remainder of whorl is smooth. Spiral sculpture absent except for a series of about five indistinct striae near anterior tip of shell. Axial growth lines present. Outer lip slightly thickened with faint stromboid notch on lower surface. Sinus on mid-shoulder, very deep, U-shaped, margin thickened. Parietal callus strong. Aperture subrectangular, deep. Columella narrow, callused margin. Shell truncate, anterior canal short, broad, deep, anterior tip distinctly notched. Entire shell off-white glossy, some specimens with a yellowish tinge between the axial ribs.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
persica					
BMNH syntypes	8.9	2.9	3.3	0.33	0.37
1874.1.19.30	8.4	2.9	3.2	0.35	0.38
	8.6	3.0	3.3	0.35	0.41
	7.0	2.3	2.9	0.33	0.41
persica var. *jacintha*					
BMNH syntypes	13.7	4.5	4.6	0.33	0.34
1925.3.12.2.3	11.7	3.7	3.7	0.32	0.32
NMW syntypes	8.7	2.8	2.8	0.32	0.32
1955.158.478	9.4	3.9	2.9	0.42	0.31

Source : MNHN, Paris

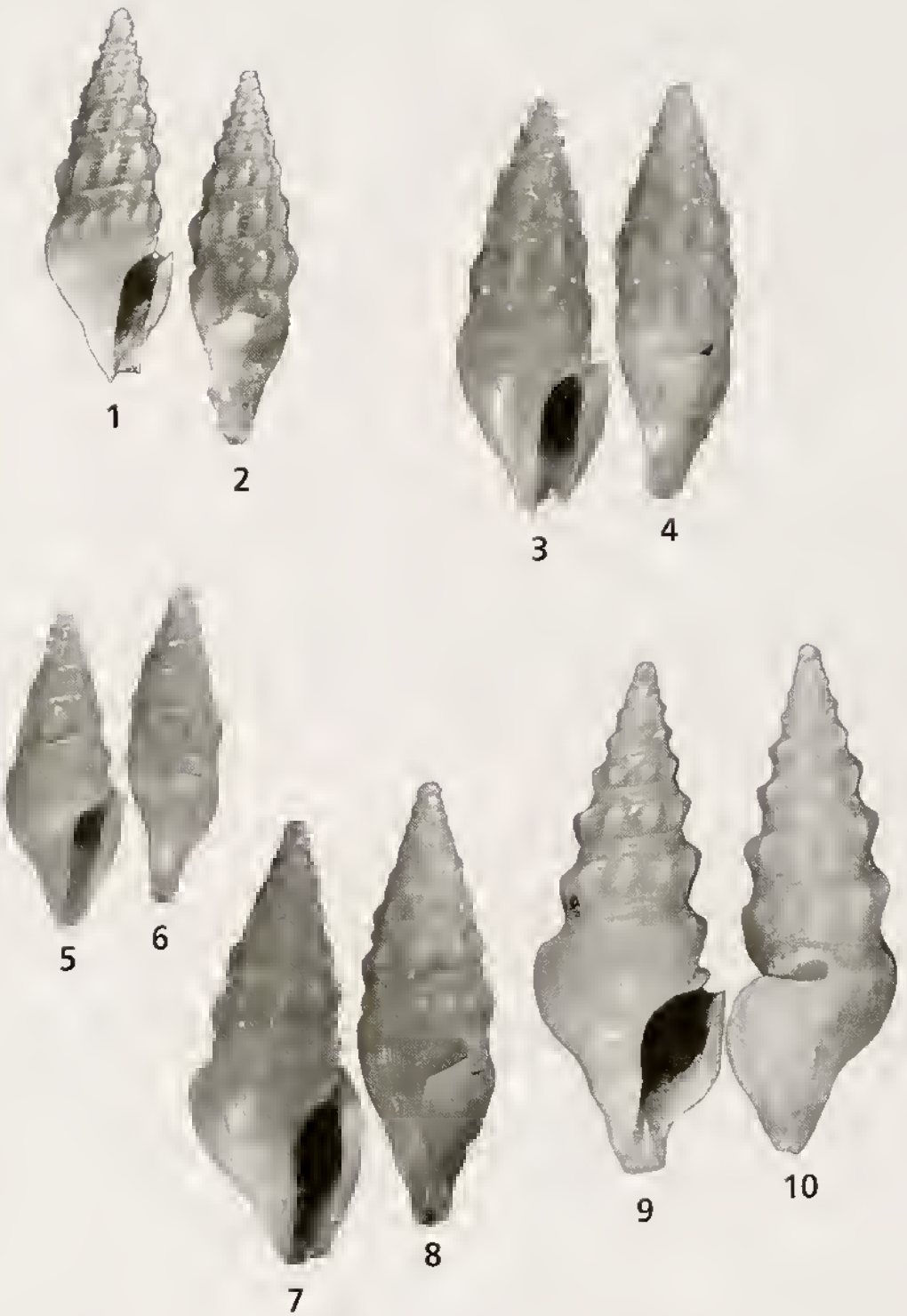

PLATE 2. — *Splendrillia*. — 1-2, *S. disjecta*. New Caledonia, LAGON: stn 830. — **3-4**, *S. persica* . New Caledonia. LAGON: stn 830. — **5-6**, *S. intermedia* sp. nov. Holotype. — **7-8**, *S. striata* sp. nov. Holotype. — **9-10**, *S. solicitata*. New Caledonia. MUSORSTOM 4: stn DW 222.

Source : MNHN, Paris

REMARKS. — The syntypes of *Drillia persica* var. *jacintha* are similar to those of *Pleurotoma persica*, but are larger (12-14 mm vs. 7-9 mm), with essentially the same number of axial ribs, 8-9 on the penultimate whorl and 7-8 on the body whorl, compared to 8-11 on both whorls of *S. persica*, and the ribs extend further down the body whorl. The basic distinction is the greater shell length of *jacintha*, and subspecific separation is not warranted.

The New Caledonian specimens are very similar, slightly smaller, with the same size protoconch, the callus and ribs are similar, but the material differs slightly in that the front face of the body whorl is smooth and slightly more pustulose just below the suture.

As discussed above, *S. persica* is similar to *S. disjecta* in shell shape: they are of the same size, have the same number of whorls, and the protoconchs are of the same size, but *S. persica* is slightly narrower, with slightly narrower ribs which do not extend as far on the face of the body whorl. A parietal callus is present on *S. persica* but not on *S. disjecta*.

Splendrillia intermedia sp. nov.

Pl. 2, Figs 5-6

TYPE MATERIAL. — Holotype MNHN. Paratype WAM 16-94.

TYPE LOCALITY. — West Indian Ocean. Mozambique Channel, BENTHEDI, stn DR 08, 11°29′ S, 47°18′ E, 250 m.

MATERIAL EXAMINED. — **West Indian Ocean.** Mozambique Channel. BENTHEDI: stn DR 08, 11°29′ S, 47°18′ E, 250 m, 1 lv (holotype). — Stn DR 33, 12°54′ S, 45°16′ E, 275-400 m, 1 dd (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 440, 20°49′ S, 167°17′ E, 288 m, 1 dd (MNHN).

DISTRIBUTION. — Mozambique Channel and New Caledonian region in depths of from 250 to at least 288 m.

DESCRIPTION. — *Shell* medium, 12 mm, high spired. *Protoconch* small, smooth with very fine microscopic pitting, rounded, of 2 whorls, 0.45-0.60 mm high, 0.70-0.75 mm wide. *Teleoconch* of 7 convex whorls. Suture thin, distinct, undulating. Sculpture dominated by strong, rounded axial ribs, of moderate width, beginning at upper suture, increasing gradually, reaching maximum below midwhorl, decreasing but still strong at lower suture, tending to match up on several adjacent whorls but not for entire spire, 8 on penultimate whorl. Two strong ribs at beginning of body whorl but remainder of face of body whorl smooth, left side swollen by strong rib. About 10 faint spiral striae near anterior tip of shell. Shell surface smooth except for faint axial growth lines. Outer lip slightly thickened, slightly incurved with distinct stromboid notch near base. Sinus subsutural, deep, 45° angle to shell axis, margins thin but distinctly raised, entrance nearly sealed by strong subsutural parietal callus. Aperture almost semicircular, outer edge straight but columellar margin distinctly rounded. Columella narrow, nearly straight, margin slightly callused. Anterior canal short, broad, shallow, anterior tip strongly notched. Shell colour glossy white with yellow patches between ribs of lower spire whorls.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	11.1	4.6	4.8	0.41	0.43
Paratype	11.8	4.6	4.4	0.39	0.37
MUSORSTOM 6 stn DW 440	7.5	2.9	3.4	0.39	0.45

REMARKS. — With its broad shape, low spire and angular whorls, *Splendrillia intermedia* is a distinctive species. It resembles a species of *Plagiostropha* with its 8 distinct ribs on the upper whorls, giving the shell an octagonal appearance in transverse section. However, *S. intermedia* can be

Source : MNHN, Paris

separated from all *Plagiostropha* by the 8 ribs as opposed to the five normal for *Plagiostropha*. In addition the ribs are not as strong and are not continuous to the body whorl.

ETYMOLOGY. — *Intermedia* refers to the shape of this species, which is somewhat intermediate between that of most *Splendrillia* and the genus *Plagiostropha*.

Splendrillia striata sp. nov.

Pl. 2, Figs 7-8

TYPE MATERIAL. — Holotype lv and 5 paratypes dd MNHN.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 156, 18°54' S, 163°19' E, 525 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. *Shell* medium size for genus, 14 mm, high spired, solid. *Protoconch* large, high, top rounded, smooth, of 2 whorls, 1.00 mm high, 1.05 mm wide. *Teleoconch* of 8 irregularly shaped whorls. Suture distinct, nearly straight, slightly adpressed. Upper whorls with subsutural spiral cord, entire surface with fine but distinct spiral striae, less visible on body whorl, anterior tip of shell with about 20 more distinct striae. Dominant sculpture is moderately strong axial ribs, which form about 1/3 down whorl, enlarging by midwhorl, decreasing only slightly to lower suture. Combination of ribs and spiral cord gives whorl outline a slight swelling on top, decreasing below cord, then ribs swell to a larger size below the spiral cord. Ribs broad, reaching low peaks, 10 on penultimate whorl, do not line up on adjacent whorls. Eight smaller ribs at beginning and front face of body whorl, final rib on left face swollen into varix, no ribs on back of body whorl, except one small rib on outer lip. Outer lip thickened, broken on holotype, but paratype has a strongly incurved lip, broad stromboid notch on lower part. Sinus just subsutural, very deep, at a 30° angle to shell axis, entrance nearly sealed by incurved outer lip and strong subsutural parietal callus. Aperture broad, subrectangular, deep. Columella narrow, slightly swollen in center, margin callused. Anterior canal short, very broad, of moderate depth. Anterior tip slightly notched. Shell colour uniform semiglossy off-white in holotype, paratypes very light brown.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	14.5	6.0	6.0	0.41	0.41
Paratypes	14.3	5.8	6.1	0.41	0.43
	14.1	5.6	5.6	0.40	0.40
	10.0	4.4	4.4	0.44	0.44

REMARKS. — *Splendrillia striata* differs from most other species of *Splendrillia* in having fine spiral striae over most of the shell surface except the body whorl. Some other species have spiral striae but they are not as distinct as in *S. striata*. *Splendrillia striata* is most similar to *S. solicitata*, but can be distinguished by being smaller (14 mm vs. 18 mm), in having fine spiral cords which are lacking on *S. solicitata*, and in its yellowish colour.

ETYMOLOGY. — *Striata* refers to the fine spiral striae on shells of this species.

Source : MNHN, Paris

Splendrillia solicitata (Sowerby, 1913)

Pl. 1, Figs 3-4; Pl. 2, Figs 9-10

Drillia solicitata Sowerby, 1913: 234, pl. 3, fig. 2.

Other reference:
Splendrillia solicitata — Powell, 1966: 84.

Type material. — Holotype BMNH 1914.1.7.275.

Type locality. — Goto, Japan.

Material examined. — The type material.
New Caledonia. MUSORSTOM 4: stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 1 dd (WAM 19-94). — Stn DW 226, 22°47′ S, 167°22′ E, 390 m, 1 lv, 1 dd (MNHN).
SMIB 2: stn DW 9, 22°54′ S, 167°15′ E, 475-500 m, 1 dd (MNHN).
SMIB 3: stn DW 29, 22°47′ S, 167°12′ E, 405 m, 1 dd (MNHN).
Loyalty Islands. MUSORSTOM 6: stn DW 468, 21°06′ S, 167°33′ E, 600 m, 1 lv (MNHN).

Distribution. — Japan and New Caledonia, in depths of from 390 to 600 m.

Description. — *Shell* medium, 14 mm, high spired, heavy. Upper whorl(s) and protoconch of holotype broken off. Seven remaining, slightly turreted teleoconch whorls. *Protoconch* of New Caledonian material high, rounded, smooth with microscopic pitting, of 2.5 whorls, 0.70 mm high, 1.00 mm wide. *Teleoconch* of 7 angular whorls. Suture distinct, slightly adpressed, nearly straight. Upper surface of whorls smooth, nearly flat, with slight, narrow, subsutural spiral cord. Axial ribs are dominant sculpture, beginning nearly halfway down whorl with distinct increase along top of ribs. Ribs of moderate width, low, rapidly swelling to maximum size, decreasing towards, but reaching lower suture, base angled to left, not lined up on adjacent whorls, 10-11 on penultimate whorl, 7 on first half of body whorl, outer half of body whorl without ribs, no varix, ribs not extending beyond shoulder. Very faint series of 10-15 spiral cords across base of body whorl. Axial growth lines numerous, distinct in places. Outer lip thick, margin smooth. Sinus very deep, U shaped, on mid-shoulder, opening constricted by heavy callus, 60° angle to shell axis. Aperture narrow, elongate oval, deep. Columella broad, slightly convex, margin raised. Shell truncate, anterior canal short, broad, deep, anterior lip distinctly notched. Shell glossy off-white with light yellowish bands above and below ribs and across middle of body whorl.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	14.1	5.5	5.2	0.39	0.37
New Caledonia	18.0	6.8	7.9	0.38	0.44
	14.8	5.3	5.3	0.36	0.36

Remarks. — The New Caledonian material is identical to the type of *Splendrillia solicitata* except that the ribs do not extend onto the face of the body whorl, and on the penultimate whorl they are not as pronounced. The ribs stop after the face of the body whorl on the holotype of *S. solicitata*. The New Caledonian specimens are variable in this regard.

Splendrillia solicitata is closest to *S. parciplicata* (Sowerby, 1915), which is of similar size and comes from the same geographic area. It may be separated from *S. parciplicata* by its broader shape and differences in the axial rib structure. The ribs of *S. parciplicata* begin higher up on the whorl, are narrower and more numerous (16 on the penultimate whorl versus 10), and extend over the entire body whorl. Another Japanese species, *S. raricostata* (Smith, 1879), is smaller (11 vs. 14 mm), narrower, has stronger axial ribs, a varix on the body whorl, and pronounced spiral cords across the base of the body whorl.

Source : MNHN, Paris

PLATE 3. — Opercula of *Splendrillia*. **1-2**, *S. houbricki*, inner and outer views, New Caledonia, BIOCAL: stn DW 66, 1.3 and 1.5 mm. — **3**, *S. elongata*, Philippines, MUSORSTOM 3, stn CP 106, 2.5 mm. — **4**, *S. triconica*, New Caledonia, BIOCAL: stn DW 44, 1.5 mm.

Splendrillia solicitata is also similar to *S. brycei*, but lacks the fine spiral striae of *S. brycei*, is larger (up to 18 mm vs. 14 mm), the axial ribs are angled to the right instead of straight and are larger and more angular.

Splendrillia solicitata is similar to a specimen labeled as *Splendrillia resplendens* (Melvill, 1898) from Karachi in the NMW. It differs in being longer, in having the ribs starting lower on the whorl, in having the left side of the body whorl more swollen, and in having the front face of the body whorl smooth, and lacking ribs.

Splendrillia taylori sp. nov.

Pl. 4, Figs 1-2

TYPE MATERIAL. — Holotype dd MNHN.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 186, 19°07′ S, 163°30′ E, 190 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* medium, 15 mm, high spired, solid. *Protoconch* small, high, conical, smooth with fine microscopic pitting, of 2 whorls, 0.70 mm wide, 0.55 mm high. *Teleoconch* of 9 angular whorls. Suture narrow, indistinct, undulating. Very thin, distinct subsutural, spiral cords, up to 10 on whorl, extending onto upper surface of ribs. Sculpture dominated by strong, but narrow and low axial ribs, 8 on penultimate whorl, beginning almost halfway down whorl, reaching rapid peak and declining but reaching lower suture, ribs slightly curved, angled to left, tending to match up on adjacent whorls. Ribs on shoulder of body whorl small, indistinct, 10 in number but an additional rib may have been obscured by a shell repair, final rib swollen into varix. About 7 distinct spiral cords near anterior tip of shell, with several fainter cords above. Faint axial growth lines present on all whorls. Outer lip thickened, strongly incurved, strong stromboid notch on lower portion. Sinus subsutural, deep, at 45° angle to shell axis, margins raised. Aperture deep, moderate width, elongate-ovate. Columella of moderate width, slightly convex, margin strongly callused. Anterior canal short, broad, deep, anterior tip strongly notched. Shell colour glossy off-white, outer lip tinged with yellowish-brown.

Source : MNHN, Paris

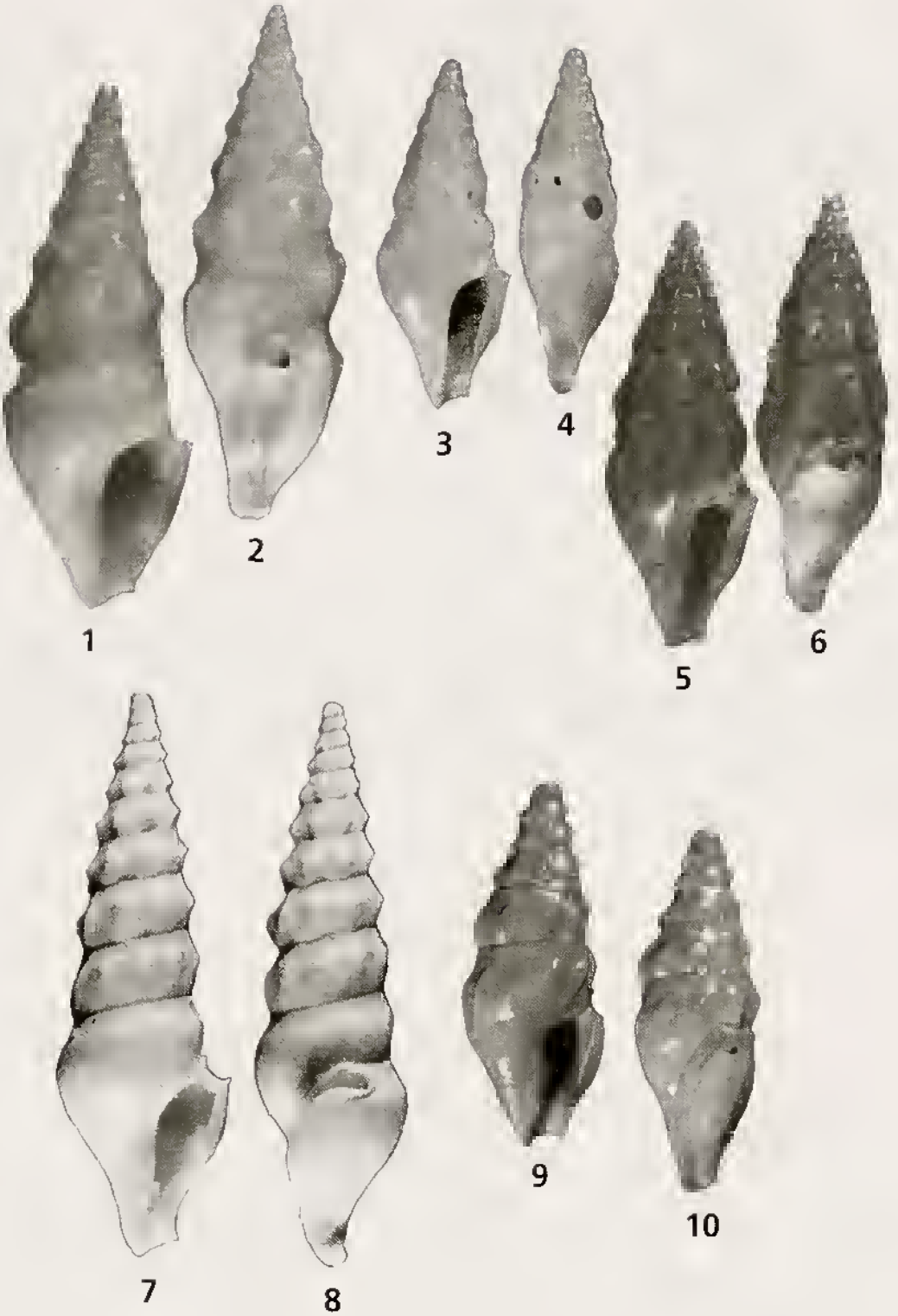

PLATE 4. — *Splendrillia*. — **1-2**, *S. taylori* sp. nov. Holotype. **3- 4**, *S. boucheti* sp. nov. Holotype. — **5-6**, *S. praeclara*, Philippines, MUSORSTOM 3; stn CP 87. — **7-8**, *S. elongata* sp. nov. Holotype. **9-10**, *S. minima* sp. nov. Holotype.

Source : MNHN, Paris

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	15.1	5.5	5.5	0.36	0.36

REMARKS. — *Splendrillia taylori* is closest to *S. striata* in having the same general shape and size and especially the presence of fine spiral striae. It can be separated by its narrower shell, with a strong varix on the outer lip instead of on the left face of the body whorl as in *S. striata*. The ribs of *S. taylori* are narrower than on *S. striata* and the beginning of the upper surface of the ribs is less distinct.

ETYMOLOGY. — This species is named after Dr John TAYLOR of the Natural History Museum, London in recognition of the considerable importance his work has had in improving our knowledge of the systematics of turrids.

Splendrillia boucheti sp. nov.

Pl. 4, Figs 3-4

TYPE MATERIAL. — Holotype dd MNHN.

TYPE LOCALITY. — Loyalty Islands, MUSORSTOM 6, stn DW 439, 20°46′ S, 167°17′ E, 288 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* small, 8 mm, biconic, very high spired. *Protoconch* small, high, smooth, of 2 whorls, 0.60 mm high, 0.70 mm wide. *Teleoconch* of 6 convex whorls. Suture strong, straight, channeled. Sculpture dominated by 7 strong axial ribs per whorl, lined up on adjacent whorls to give shell heptagonal shape. Subsutural spiral cord becomes progressively less distinct on lower whorls, nodulose on upper part of rib, continuous with rib from preceding whorl. Rib decreases below cord, then expands at middle of whorl. Ribs broad at base but narrow rapidly to form narrow top. First and second ribs of body whorl progressively smaller and less distinct, third rib swollen on left side of front of body whorl, back of body whorl lacking ribs. Numerous axial growth lines present, but very faint. Outer lip slightly thickened, small narrow axial rib on outer surface, lip incurved, no stromboid notch on lower edge. Sinus on outer shoulder, well down from suture, broad, deep, U-shaped, margins raised, at 30° angle to shell axis. Strong parietal callus present, but not blocking entrance to sinus. Aperture broad, deep, subrectangular, lower end not narrowed. Columella very narrow, slightly convex, margin strongly callused. Anterior canal short, broad, deep, anterior lip of shell notched. Shell colour glossy white with slight yellowish tinting between some of the ribs.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	7.9	3.1	3.5	0.39	0.44

REMARKS. — As with *Splendrillia intermedia*, *S. boucheti* has a resemblance to species of the genus *Plagiostropha*. It differs in being heptagonal and in having ribs which are not as strong as in *Plagiostropha*.

ETYMOLOGY. — I am pleased to name this species after Dr Philippe BOUCHET of the MNHN in recognition of his substantial contributions to malacology and his generosity in making the material used for this paper available to me.

Source : MNHN, Paris

Splendrillia praeclara (Melvill, 1893)

Pl. 4, Figs 5-6

Drillia praeclara Melvill, 1893: 1, pl. 1.

Other reference:
Drillia praeclara – Melvill, 1917: 161.

Type material. — Holotype BMNH 1893.2.16.11, 2 paratypes 1955.158.494 NMW (*fide* Trew).

Type locality. — Bombay, India.

Material examined. — The type material.
Philippines. MUSORSTOM 1: stn DR 14, 14°00′ N, 120°17′ E, 190 m, 1 lv (MNHN). — Stn DR 15, 14°00′ N, 120°18′ E, 188-192 m, 1 dd (MNHN).
MUSORSTOM 3: stn CP 87, 14°00′ N, 120°19′ E, 191-197 m, 1 dd (MNHN). — Stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 1 dd (MNHN).
New Caledonia. LAGON: stn 80, 22°31′ S, 166°28′ E, 33 m, 1 dd (MNHN).

Distribution. — India and the Philippines in depths from 190 to 214 m.

Description. — *Shell* small, 8 mm, high spired. *Protoconch* small, rounded, of 2 whorls, second whorl has faintly developed axial ribs, 0.75 mm high, 0.75 mm wide. *Teleoconch* of 6 convex whorls. Suture distinct, slightly impressed, strongly undulating. Single strong, undulating subsutural spiral cord. Dominant sculpture of strong, broad axial ribs which begin at base of spiral cord, are smooth surfaced, broadest at midrib, extend to lower suture where they are still strong, do not line up on adjacent whorls, 7 ribs on penultimate whorl, 4 on body whorl followed by strong varix, last half of body whorl nearly smooth with several indistinct ribs. 7 distinct spiral cords just above anterior tip of shell. Faint growth lines present. Outer lip thickened, incurved, faint stromboid notch on lower edge. Sinus very deep, at 45° angle to shell axis, U-shaped, margin partially closed by strong callus. Aperture narrow, subrectangular, deep. Columella narrow, slightly convex, margin distinct. Shell truncate, anterior canal short, very broad, deep, anterior tip strongly notched. Shell colour glossy light pink.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	7.9	3.2	3.2	0.41	0.41

Remarks. — *Splendrillia praeclara* is most similar in size and shape to *S. jarosae* Wells, 1991 from northern Australia, but differs in having fewer (7 vs. 16 on penultimate whorl), but stronger axial ribs, and a stronger, undulating spiral cord. *Splendrillia praeclara* may also be compared to *S. persica* and *S. raricostata* (Smith, 1879) but differs by its broader shell with broader axial ribs, and in having a strong subsutural spiral cord.

A shell from New Caledonia [LAGON: stn 80, 22°31′ S, 166°28′ E, 33 m (MNHN)] differs from the material from the Philippines by having a multispiral protoconch.

Splendrillia elongata sp. nov.

Pl. 1, Figs 5-6; Pl. 3, Fig. 3; Pl. 4, Figs 7-8

Type material. — Holotype MNHN. Paratypes: 12 MNHN, 1 WAM 18-94.

Type locality. — Chesterfield Islands. MUSORSTOM 5, stn 322, 21°19′ S, 158°00′ E, 975 m.

Source : MNHN, Paris

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 8 lv, 14 dd.
Chesterfield Islands. MUSORSTOM 5: stn 321, 21°20′ S, 158°02′ E, 1000 m, 1 lv (paratype). — Stn 322, 21°19′ S, 158°00′ E, 975 m, 5 dd (holotype and paratypes). — Stn 326, 21°07′ S, 157°47′ E, 980 m, 1 dd (paratype WAM 18-94). — Stn 357, 19°37′ S, 158°46′ E, 630 m, 1 dd (paratype). — Stn 390, 21°01′ S, 160°50′ E, 745-825 m, 1 dd (paratype).
New Caledonia. *"Vauban"* 1978-79: stn 32, 22°32′ S, 166°25′ E, 430-500 m, 1 dd (paratype).
BIOGEOCAL: stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 2 dd (paratypes). — Stn DW 291, 20°34′ S, 166°54′ E, 510-520 m, 1 dd (paratype). — Stn DW 311, 20°49′ S, 166°54′ E, 1620 m, 1 dd (paratype).

DISTRIBUTION. — Philippines to New Caledonia and Chesterfield Islands in depths of from 430 to 1620 m.

DESCRIPTION. — *Shell* large, 17 mm, very high spired, narrow. *Protoconch* small, high, dome-shaped, smooth with very fine microscopic pitting, of 2 whorls, light orange colour, 0.69 mm high, 0.78 mm wide. *Teleoconch* up to 10 whorls, triangular in outline. Suture thin, nearly straight, slightly channeled. Dominant sculpture of strong axial ribs, which form just below suture but are indistinct, rise to sudden peak in centre, just below midwhorl, decrease but reach lower suture, and are of nodulose shape, ribs absent on body whorl, 11 on penultimate whorl but first few are very faint and become stronger going up the spire, ribs do not match up on adjacent whorls. Slight spiral striae on shoulder just above nodulose part of rib. Very faint spiral striae on whorl surface, last 6 near anterior lip of body whorl are stronger. Axial growth lines faint. Outer lip slightly thickened, slightly incurved, distinct stromboid notch on lower edge. Sinus subsutural, broad, deep, U-shaped, margins slightly raised and thickened. Small subsutural callus which does not block entrance to sinus. Aperture of moderate width, elongate-ovate, deep. Columella thin, smooth, nearly straight, margin slightly callused. Anterior canal moderately long, of moderate width, slightly curved to right at base. Shell colour uniform glossy white except for light orange protoconch.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	17.1	5.2	5.8	0.30	0.34
Paratypes stn 322 ($n=4$)					
Range	14.3-16.7	4.1-5.2	4.1-5.8	0.29-0.31	0.29-0.35
Mean	15.5	5.0	5.1	0.32	0.33
SD	1.0	0.6	0.6	0.02	0.03

REMARKS. — The very high spire of *Splendrillia elongata* is the key feature of this species, and distinguishes it from all of the other *Splendrillia* collected in the New Caledonia sampling program. *Splendrillia elongata* is closest to two southern Australian species, *S. lygadina* (Hedley, 1922) and *S. acostata* (Verco, 1909). Both Australian species are somewhat larger, *S. lygadina* reaching 24 mm and *S. acostata* 21 mm, compared to 17 mm for *S. elongata*. *Splendrillia elongata* is intermediate in sculpture between the smooth *S. acostata* which lacks axial ribbing and the very heavily ribbed *S. lygadina*.

There is an unidentified turrid species in the New Caledonian material which is very similar to *Splendrillia elongata*. The two can be easily separated by the number of whorls of the protoconch: 2 whorls in *S. elongata* and 4 high whorls in the unidentified species.

ETYMOLOGY. — *Elongata* refers to the very high spire of this species.

Splendrillia minima sp. nov.

Pl. 4, Figs 9-10

TYPE MATERIAL. — Holotype MNHN. Paratypes: 4 MNHN, 1 WAM 21-94.

TYPE LOCALITY. — Philippines, MUSORSTOM 3, stn DR 94, 13°47′ N, 120°03′ E, 842 m.

Source : MNHN, Paris

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd (holotype). — Stn CP 139, 11°53′ N, 122°14′ E, 240-267 m, 1 dd (paratype WAM 21-94). — Stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 4 dd (paratypes).

DISTRIBUTION. — The Philippines in depths of from 205 to 842 m.

DESCRIPTION. — *Shell* very small, 6 mm, high spired, solid. *Protoconch* small, dome shaped, smooth, of 1 whorl, 0.55 mm wide, 0.30 mm high. *Teleoconch* of 6 angular whorls. Suture distinct, slightly undulating, slightly constricted. One nodulose subsutural spiral cord, nodules continuation of ribs from upper whorl. Dominant sculpture of strong, broad, low axial ribs, which tend to line up on upper whorls, form 1/3 down whorl, increase markedly by midwhorl, and decrease slightly but are still strong at lower suture, 9 on penultimate whorl, 5 small ribs on face of body whorl, sixth rib on left swollen into strong varix, back of whorl lacks ribs. Axial growth lines present but very faint. Seven distinct small spiral cords near anterior tip of shell. Outer lip slightly thickened with slight, shallow stromboid notch near lower end. Sinus subsutural, very deep, at 30° angle to shell axis, margins raised, entrance constricted by strong subsutural callus. Aperture broad, subrectangular, deep. Columella narrow, nearly straight, margin callused. Anterior canal short, broad, of moderate depth. Anterior tip distinctly notched. Shell colour uniform glossy light gray.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	5.9	2.3	2.0	0.39	0.38
Paratype stn CP 143	6.2	2.5	2.7	0.40	0.44

REMARKS. — *Splendrillia minima* is similar to *S. disjecta* and is of the same size, but the protoconch is more dome-shaped, and the ribs are less numerous, are angled to the left, and do not extend down the body whorl.

ETYMOLOGY. — This species is named for its small size in relation to other species of the genus.

Splendrillia brycei sp. nov.

Pl. 5, Figs 1-2

TYPE MATERIAL. — Holotype MNHN. Paratypes: 11 MNHN, 3 WAM 117-94.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 48, 23°00' S, 167°29' E, 775 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 48, 23°00′ S, 167°29′ E, 775 m, 1 dd (holotype). — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 2 lv, 11 dd, (paratypes: 10 MNHN, 3 WAM 117-94). — Stn DW 56, 23°35′ S, 167°12′ E, 695-705 m, 1 dd (paratype).

DISTRIBUTION. — New Caledonia in depths of from 680 to 775 m.

DESCRIPTION. — *Shell* small, up to 9 mm, high spired. *Protoconch* large, smooth, globose, of 2 whorls, 0.65 mm high, 0.95 mm wide. *Teleoconch* of 5 angular whorls. Suture distinct, slightly undulating. Dominant sculpture of strong, narrow axial ribs. Upper surface of whorl smooth, ribs begin just above midwhorl, enlarge rapidly, reach maximum at or near midwhorl, decrease but reach lower suture. Ribs do not match up on adjoining whorls; 9 on body whorl, first strong, but ribs decrease in intensity, do not extend below shoulder, last half of whorl lacks ribs, 10 ribs on penultimate whorl. Anterior tip of shell lacks spiral grooves. Shell surface smooth. Outer lip slightly incurved, slightly thickened. Sinus subsutural, very deep, U-shaped, with strong subsutural callus constricting entrance, at 30° angle to shell axis. Aperture large, broad, elongate-oval, deep. Columella nearly straight, of moderate width, smooth, margin callused. Anterior canal short, broad, shallow, anterior tip notched. Shell colour uniform glossy white.

Source : MNHN, Paris

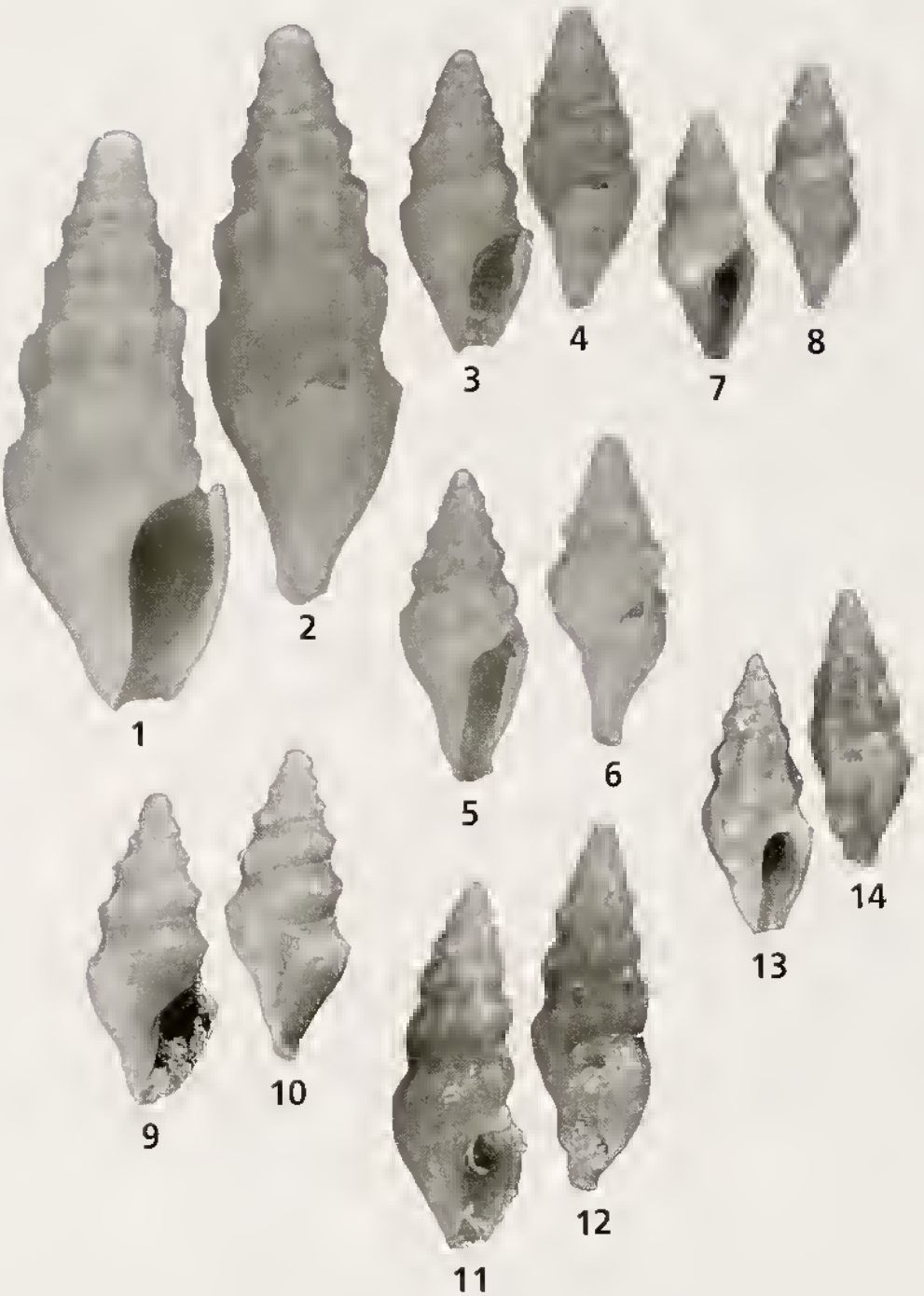

PLATE 5. — *Splendrillia*. — **1-2**, *S. brycei* sp. nov. Holotype. — **3-4**, *S. carolae* sp. nov. Holotype. — **5-6**, *S. wayae* sp. nov. Holotype. — **7-8**, *S. houbricki* sp. nov. Holotype. — **9-10**, *S. angularia* sp. nov. Holotype. — **11-12**, *S. problematica* sp. nov. Holotype. — **13-14**, *S. triconica* sp. nov. Holotype.

Source : MNHN, Paris

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	7.4	3.2	3.3	0.43	0.45
Paratypes stn DW 51	9.2	3.9	3.7	0.42	0.40
	9.1	4.0	3.8	0.44	0.42
	9.0	3.8	4.0	0.42	0.44

REMARKS. — Together with the next two species *Splendrillia brycei* is part of a species complex of three New Caledonian *Splendrillia* that are similar in size and shape, and are very closely related. *Splendrillia brycei* is characterized by its uniformly white colour, large size, large, globose protoconch, and the smooth base of the body whorl. *Splendrillia wayae* is smaller, has a smaller protoconch, and broad subsutural spiral cord. *Splendrillia carolae* is smaller than *S. brycei*, also has a smaller protoconch, a yellow-brown subsutural spiral cord, and spiral grooves on the base of the body whorl.

Splendrillia brycei is also similar to *S. houbricki* in size and shape, but is slightly larger (10 mm vs. 7 mm), with a larger protoconch (0.65 mm vs. 0.35 mm), and has broader, weaker axial ribs which do not extend completely from the upper to the lower suture.

Splendrillia brycei is similar to specimens in the NMW labeled as *S. raricostata* (Smith, 1879), but these do not agree with the BMNH holotype of *S. raricostata*. The NMW specimens are from Nagasaki, Japan.

ETYMOLOGY. — This species is named after Mr C.W. Bryce of the Western Australian Museum in acknowledgement of the considerable assistance he has provided to my turrid research over the last several years.

Splendrillia carolae sp. nov.

Pl. 1, Fig. 7; Pl. 5, Figs 3-4

TYPE MATERIAL. — Holotype dd MNHN. Paratypes 65 MNHN, 3 WAM 23-94.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 46, 22°53' S, 167°17' E, 570-610 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 44, 22°47' S, 167°14' E, 440-450 m, 34 dd (paratypes). — Stn DW 46, 22°53' S, 167°17' E, 570-610 m, 21 dd & 10 lv (1 destroyed for radula preparation) (holotype and paratypes). — Stn DW 51, 23°05' S, 167°45' E, 680-700 m, 3 dd (paratypes WAM 23-94).

DISTRIBUTION. — New Caledonia in depths of from 440 to 700 m.

DESCRIPTION. — *Shell* small, up to 8 mm, high spired. *Protoconch* large, smooth, globose, of 2 whorls, 0.35 mm high, 0.70 mm wide. *Teleoconch* of 5 angular whorls. Suture distinct, slightly undulating. Subsutural spiral cord present. Dominant sculpture of strong, narrow axial ribs. Upper surface of whorl smooth, ribs begin just above midwhorl, enlarge rapidly, reach maximum at or near midwhorl, decrease but reach lower suture. Ribs do not match up on adjoining whorls; first rib of body whorl strong but ribs decrease rapidly in strength, last half of whorl smooth, 10 ribs on penultimate whorl. Anterior lip of shell lacks fine spiral striae. Axial growth lines present but faint. Shell surface smooth. Outer lip slightly incurved, slightly thickened. Sinus subsutural, very deep, U-shaped, with strong subsutural callus constricting entrance, at 30° angle to shell axis. Aperture large, broad, elongate-oval, deep. Columella nearly straight, of moderate width, smooth, margin callused. Anterior canal short, broad, shallow, anterior tip notched. Shell colour glossy off-white with broad, faint yellowish-brown band across centre of body whorl.

Source : MNHN, Paris

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	7.6	3.3	3.1	0.40	0.37
Paratypes ($n=13$)					
Range	7.1-7.8	2.8-3.5	2.7-3.3	0.34-0.49	0.38-0.43
Mean	7.4	3.2	3.0	0.43	0.41
SD	0.2	0.3	0.2	0.04	0.02

REMARKS. — *Splendrillia carolae* can be distinguished from *S. brycei* by its slightly smaller size (8 vs. 9 mm), smaller protoconch (0.35 vs. 0.95 mm high), subsutural spiral cord, and the spiral band across the centre of the body whorl. *Splendrillia carolae* can be separated from *S. wayae* by being larger (8 mm vs. 6 mm), its more globose protoconch, and the lack of spiral grooves above the base of the shell.

ETYMOLOGY. — This species is named after Dr. Carol M. LALLI, my PhD thesis supervisor, in grateful recognition of her invaluable help and encouragement both during the course of my PhD research and in the subsequent years.

Splendrillia wayae sp. nov.

Pl. 5, Figs 5-6

TYPE MATERIAL. — Holotype lv MNHN. Paratypes: 128 lv and dd MNHN, 3 dd WAM 118-94.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 46, 22°53′ S, 167°17′ E, 570-610 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — New Caledonia in depths of from 570 to 610 m.

DESCRIPTION. — *Shell* small, up to 6 mm, high spired. *Protoconch* narrow, smooth, of 2 whorls, 0.45 mm high, 0.65 mm wide. *Teleoconch* of 5 angular whorls. Suture distinct, slightly undulating. Dominant sculpture of strong, narrow axial ribs. Upper surface of whorl smooth, ribs begin just above midwhorl, enlarge rapidly, reach maximum at or near midwhorl, decrease but reach lower suture, angled strongly to the left. Ribs line up on adjoining whorls; 7 on body whorl, final rib swollen into varix, last portion of whorl smooth, 11 ribs on penultimate whorl. Anterior tip of shell with about 10 very fine spiral striae, but no other spiral sculpture. Axial growth lines present but faint. Shell surface smooth. Outer lip slightly incurved, slightly thickened. Sinus subsutural, very deep, U-shaped, with strong subsutural callus constricting entrance, at 30° angle to shell axis. Aperture large, broad, elongate-oval, deep. Columella nearly straight, of moderate width, smooth, margin callused. Anterior canal short, broad, shallow, anterior tip notched. Shell colour glossy white with yellow-brown subsutural spiral band.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	5.3	2.2	2.5	0.42	0.47
Paratypes					
Range	5.4-6.2	2.3-2.8	2.3-2.9	0.40-0.54	0.42-0.54
Mean	5.6	2.6	2.7	0.47	0.47
SD	0.3	0.2	0.3	0.05	0.05

REMARKS. — *Splendrillia wayae* is similar to *S. brycei* in size and shape, but is smaller (6 mm vs. 9 mm), with a smaller protoconch (0.45 mm vs. 0.65 mm high), the base of the body whorl has

Source : MNHN, Paris

spiral grooves, and there is a yellow-brown subsutural spiral band. *Splendrillia carolae* is also close to *S. wayae*, but lacks the spiral grooves and subsutural band.

ETYMOLOGY. — This species is named after Ms Kathie WAY of the Natural History Museum, London in acknowledgement of the considerable assistance she has provided to my turrid research over the last several years through the loan of material and providing information on specimens in the BMNH collection.

Splendrillia houbricki sp. nov.

Pl. 3, Figs 1-2; Pl 5, Figs 7-8

TYPE MATERIAL. — Holotype MNHN. Paratypes: 113 MNHN, 4 WAM 20-94.

TYPE LOCALITY. — West Indian Ocean, Mozambique Channel, BENTHEDI, stn DS 120, 11°30′ S, 47°25′ E. 335-390 m.

MATERIAL EXAMINED. — **West Indian Ocean**. Mozambique Channel, BENTHEDI: stn DS 120, 11°30′ S, 47°25′ E, 335-390 m, 1 dd (holotype).
New Caledonia. BIOCAL: stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 27 lv, 26 dd (paratypes). — Stn DW 66, 24°55′ S, 168°22′ E, 505-515 m. 25 lv (1 destroyed for radula preparation), 34 dd (paratypes). CHALCAL 2: stn CC 2, 24°55′ S, 168°21′ E, 500 m, 1 lv (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 468, 21°06′ S, 167°33′ E, 600 m, 4 dd (paratypes WAM).

DISTRIBUTION. — Only known from the Mozambique Channel and New Caledonia in depths of from 335 to 600 m.

DESCRIPTION. — *Shell* small, up to 6.5 mm, high spired. *Protoconch* small, low, rounded, smooth, of 1.5 whorls, 0.65 mm wide, 0.35 mm high. *Teleoconch* of 5 convex whorls. Suture thin, distinct, slightly undulating. Whorls convex, but some slightly angular. Sculpture dominated by strong, narrow axial ribs, which begin at upper suture but remain small on shoulder, enlarge rapidly, reach maximum 1/3 down whorl, taper off but reach lower suture, and tend to line up on adjacent lower whorls; 9 on body whorl, third from last enlarged into varix, not extending past shoulder of body whorl, 9 on penultimate whorl. Faint axial growth striae present, but shell surface generally smooth. About 8 spiral striae near anterior lip of shell, but these may be very faint. Outer lip thin, faint stromboid notch near lower margin. Sinus deep, broad, U-shaped, margins slightly raised but not thickened, at 30° angle to shell axis, parietal callus small, subsutural. Aperture broad, of moderate depth, elongate-ovate. Columella narrow, smooth, nearly straight, slightly callused. Anterior canal short, broad, shallow. Shell colour uniform glossy white or transparent. Some paratypes have a thin subsutural yellow line.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	4.5	2.2	2.3	0.49	0.51
Paratypes					
BIOCAL stn DW66 ($n=9$)					
Range	4.5-6.5	2.2-2.4	2.1-2.5	0.36-0.47	0.41-0.54
Mean	5.5	2.3	2.4	0.41	0.45
SD	0.6	0.1	0.1	0.03	0.05

REMARKS. — *Splendrillia houbricki* is very close to *S. brycei* in size, shape and general structure. It is smaller (up to 6.5 mm vs. up to 9 mm), has a smaller protoconch (0.35 mm high vs. 0.65 mm), and has ribs that extend from suture to suture and are narrower and stronger.

Source : MNHN, Paris

Splendrillia houbricki can also be compared with *S. nenia* (Hedley, 1903) from New South Wales, Australia, which has the same size and shape. However, *S. nenia* can be distinguished from *S. houbricki* by its more numerous axial ribs (12 on the penultimate whorl and 10 on the body whorl), and more angular sculpture. *Splendrillia houbricki* can be separated from *S. powelli* Wells, 1990, from Queensland, Australia by being smaller (up to 7 mm vs. 9 mm), with distinctly less angular ribs which extend completely from the upper to the lower suture instead of only part of the way. *Splendrillia powelli* Wells, 1990 is a secondary homonym of *S. powelli* (King, 1934). A replacement name will be proposed for *S. powelli* Wells, 1990 (J. K. TUCKER pers. comm.).

ETYMOLOGY. — I take pleasure in naming this new species after the late Richard ("Joe") HOUBRICK.

Splendrillia angularia sp. nov.

Pl. 5. Figs 9-10

TYPE MATERIAL. — Holotype and 1 paratype MNHN.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DC 168, 18°48′ S, 163°11′ E, 720 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DC 168, 18°48′ S, 163°11′ E, 1 dd (holotype).
BIOCAL: stn CP 61, 24°11′ S, 167°32′ E, 1070 m, 1 dd (paratype).

DISTRIBUTION. — New Caledonia in depths of from 720 to 1070 m.

DESCRIPTION. — *Shell* small, 8 mm, high spired, heavy. *Protoconch* high, rounded, of 2 whorls, smooth with microscopic pitting, 1.05 mm wide, 0.75 mm high. *Teleoconch* of 5 angular whorls. Suture distinct, thin, nearly straight, very slightly channeled. Sculpture dominated by strong axial ribs. Shoulder smooth, ribs begin about 1/3 down whorl, increase rapidly to maximum at mid-whorl, decrease but reach lower suture, and are strongly triangular in outline with sharp peak, 15 on body whorl, 11 on penultimate whorl, and do not extend far down body whorl. About 10 indistinct spiral cords near anterior tip of shell. Numerous indistinct axial growth lines on body whorl. Outer lip chipped in holotype, more broken in paratype. Sinus subsutural, deep V-shaped, margins not raised, no callus present. Aperture broad, deep, subrectantular with lower end slightly narrowed. Columella narrow, distinctly convex, margin slightly callused. Anterior canal short, very broad, shallow, anterior tip not notched. Shell colour uniform semiglossy off-white.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	8.3	3.6	3.5	0.43	0.42

REMARKS. — *Splendrillia angularia* is closest to *S. brycei* but is smaller (8 mm vs. 10 mm), has a larger protoconch (0.75 mm high vs. 0.65 mm), and has more angular ribs which are also more numerous (15 vs. 9 on the body whorl).

ETYMOLOGY. — *Angularia* refers to the angular appearance of the whorl outlines of this species.

Source : MNHN, Paris

Splendrillia problematica sp. nov.

Pl. 5, Figs 11-12

TYPE MATERIAL. — Holotype dd MNHN.

TYPE LOCALITY. — New Caledonia, CHALCAL 2, stn DW 71, 24°42′ S, 168°10′ E, 230 m.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* small, 8 mm, narrow, high spired. *Protoconch* high, conical, of 3 whorls but upper whorl broken off, smooth with microscopic pitting. *Teleoconch* of 6 convex whorls. Suture thin, distinct, undulating. Dominant sculpture of strong narrow, low axial ribs which begin at upper suture, expand to midwhorl, decrease but are still strong at lower suture, and do not line up on adjacent whorls. Ribs are narrow at base, but become much narrower near top, and are slightly curved and angled to the left; 12 on body whorl, 11 on penultimate whorl, ribs on body whorl reaching almost to anterior tip of shell. Axial growth lines present but very faint. About 15 faint spiral cords just above anterior tip of shell. Outer lip slightly thickened with distinct stromboid notch just above base. Sinus subsutural, very deep, margins raised, at 45° angle to shell axis, entrance constricted by strong subsutural parietal callus. Aperture wide, subrectangular, deep. Columella narrow, nearly straight, margin callused. Anterior canal short, broad, deep. Anterior tip slightly notched. Shell colour glossy white with light yellow subsutural line on each whorl, three on body whorl — subsutural, across middle of whorl, and on lower whorl.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	7.7	2.9	2.8	0.38	0.36

REMARKS. — *Splendrillia problematica* is closest to *S. triconica*, and shares with it the high conical protoconch of three whorls and small, distinct stromboid notch on the lower edge of the outer lip. Because of the three whorls of the protoconch *S. problematica* is only tentatively placed in *Splendrillia*. *Splendrillia problematica* differs from *S. triconica* in being slightly larger (8 vs. 6 mm), in having 6 vs. 5 teleoconch whorls, lacking a varix on the body whorl, and in having narrower, more numerous (11-12 vs. 7) axial ribs on the lower whorls.

ETYMOLOGY. — *Problematica* refers to the uncertainty of the generic status of this species.

Splendrillia triconica sp. nov.

Pl. 1, Fig. 8; Pl. 3, Fig. 4; Pl. 5, Figs 13-14

TYPE MATERIAL. — Holotype lv MNHN. Paratypes: 25 lv and dd, MNHN, 5 dd WAM 15-94

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 44, 22°47′ S, 167°14′ E, 440-450 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* very small, 6 mm, high spired, broad. *Protoconch* high, conical, of 3 whorls, smooth with microscopic pitting, 0.72 mm wide, 0.63 mm high. *Teleoconch* of 5 convex whorls, which increase rapidly in size so the base of each whorl is substantially broader than top. Suture distinct, undulating, slightly channeled. Spiral sculpture of several very indistinct subsutural striae. Dominant sculpture of strong, narrow axial ribs, continuous on some, but not all, adjacent whorls, 7 on penultimate whorl, 7 on body whorl, final rib on body whorl swollen into strong varix, ribs extending well down body whorl almost to tip of shell. Numerous very fine axial growth lines. About 8 very

Source : MNHN, Paris

faint spiral cords at base of shell. Outer lip slightly thickened with small, strong stromboid notch just above base. Sinus subsutural, on mid-shoulder, deep, margins strongly raised, entrance nearly sealed by strong callus. Aperture broad, elongate-oval, deep. Columella very narrow, nearly straight, margin slightly callused. Anterior canal short, very broad, of moderate depth, anterior tip slightly notched. Shell colour glossy white with yellow bands between ribs and two bands across body whorl, one subsutural and one at midwhorl.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	5.9	2.5	2.6	0.42	0.42
Paratypes ($n=6$)					
Range	5.2-6.2	2.2-2.5	2.2-2.7	0.39-0.44	0.41-0.49
Mean	5.6	2.3	2.4	0.42	0.44
SD	0.4	0.1	0.2	0.02	0.03

REMARKS. — *Splendrillia triconica* is placed provisionally in *Splendrillia* despite having a protoconch of three whorls. In this regard it is similar to *S. problematica*, but can be separated from that species by being slightly smaller (6 mm vs. 8 mm), with broader, less numerous (7 vs. 11-12) axial ribs on the lower whorls.

The heptagonal shape of *Splendrillia triconica* is similar to that of *S. boucheti*, but the former species differs in having a protoconch of 3 whorls, a much broader shape, a broader aperture, a strong varix, and in having axial ribs present on the entire body whorl.

ETYMOLOGY. — *Triconica* refers to the conical protoconch of three whorls.

Splendrillia globosa sp. nov.

Pl. 6. Figs 1-2

TYPE MATERIAL. — Holotype MNHN. Paratypes: 4 MNHN, 2 WAM 22-94.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 227, 22°46′ S, 167° 20′ E, 300 m.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 16, 22°46′ S, 167°12′ E, 390-400 m, 1 dd (paratype).
MUSORSTOM 4: stn DW 227, 22°46′ S, 167°20′ E, 300 m, 2 dd (holotype and paratype).
P. Tirard coll., ca. 22°40′ S to 22°50′ S, 167°10′ E to 167°30′ E, 200-350 m, 3 dd (paratypes: 1 MNHN, 2 WAM 22-94).

DISTRIBUTION. — New Caledonia in depths of 200 to 400 m.

DESCRIPTION. — *Shell* large for genus, to 17 mm, high spired. *Protoconch* low, rounded, smooth, of 2 whorls, 0.55-0.70 mm high, 0.90-0.95 mm wide. *Teleoconch* of 7 slightly rounded whorls. Suture thin, distinct, nearly straight, slightly channeled on upper whorls. Whorls generally smooth, upper 4 teleoconch whorls with 8 strong, narrow axial ribs which line up on adjacent whorls, extend from suture to suture, and are slightly larger on lower half of whorl. These ribs begin to give out on the fourth whorl, and the shell surface becomes smooth. Body whorl smooth except for a large varix on back half. Entire shell surface with very fine, microscopic spiral striae and axial growth striae. Outer lip slightly thickened with distinct stromboid notch on lower surface. Sinus subsutural, very deep, entrance slightly constricted by distinct callus, at 30° angle to shell axis. Aperture elongate, of moderate width, deep, outer margin nearly straight, inner margin somewhat semicircular. Columella smooth, narrow, slightly convex, shell truncate, anterior canal short, broad, moderate depth, anterior tip notched. Shell colour light pink or glossy white.

Source : MNHN, Paris

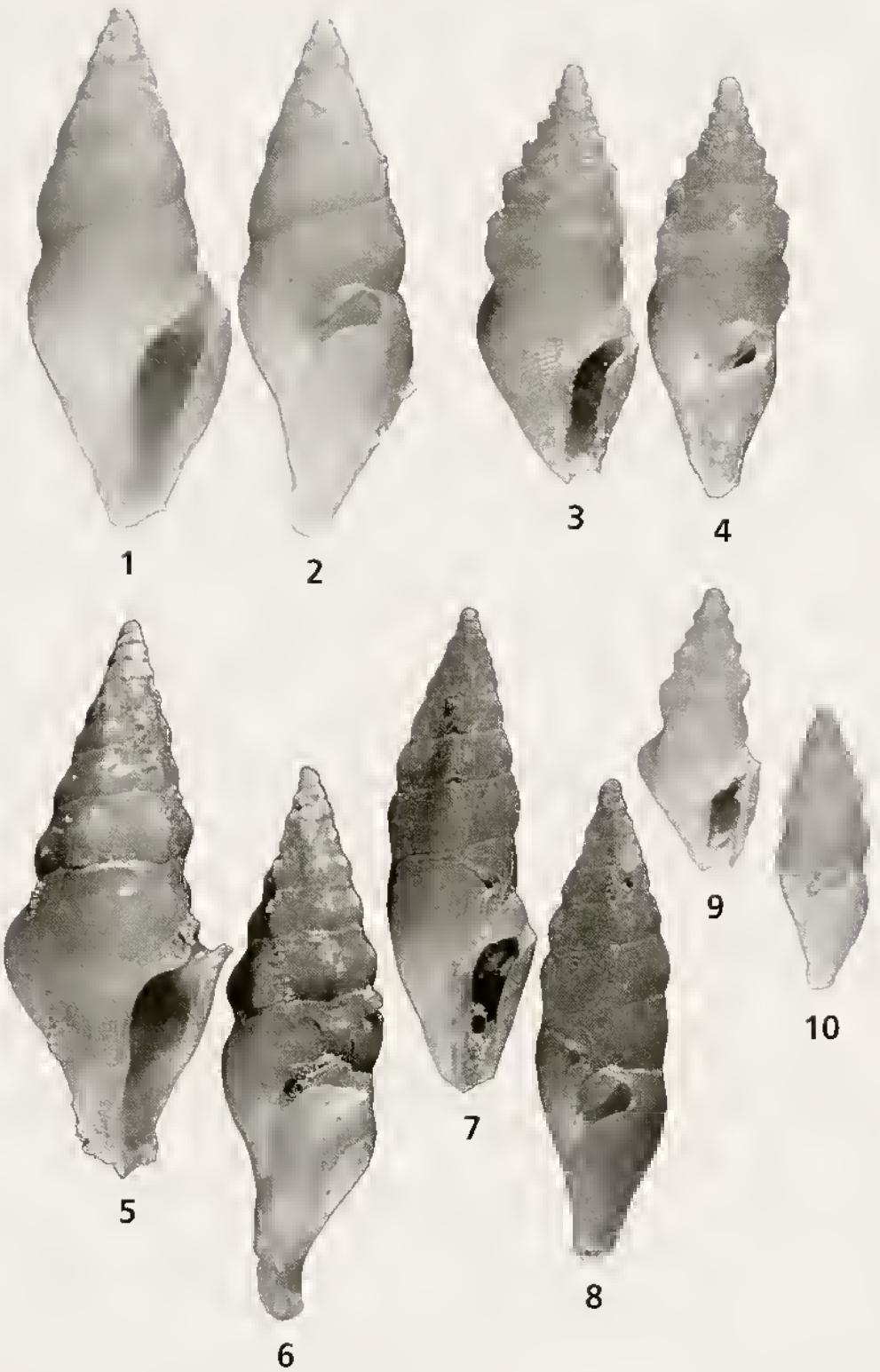

PLATE 6. — *Splendrillia* and *Plagiostropha*. — **1-2**, *S. globosa* sp. nov. Holotype. — **3-4**, *P. turrita* sp. nov. Holotype. — **5-6**, *P. hexagona* sp. nov. Holotype. — **7-8**, *P. caledoniensis* sp. nov. Holotype. — **9-10**, *P. costata* sp. nov. Holotype.

Source : MNHN, Paris

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	16.3	6.5	7.2	0.40	0.44
Paratype stn 16	11.3	4.3	4.8	0.38	0.42
Paratype Tirard coll.	16.5	6.2	6.7	0.38	0.41
	14.3	5.7	6.3	0.40	0.44
Paratype stn DW 227	12.7	5.1	5.2	0.40	0.41

REMARKS. — The characteristic feature of *Splendrillia globosa* is the smooth shell surface on the later whorls, interrupted only by the strong varix on the body whorl. This smooth surface separates *Splendrillia globosa* from all of the other New Caledonian *Splendrillia*. The smooth surface is shared by *S. gratiosa* (Sowerby, 1896) from southern Australia. In addition to being from a separate geographical region, *S. gratiosa* can be separated from *S. globosa* by having a narrower shell with a higher spire.

ETYMOLOGY. — *Globosa* refers to the broad shape of this species.

Genus *Plagiostropha* Melvill, 1927

Plagiostropha Melvill, 1927: 151. Type species: *Plagiostropha quintuplex* Melvill 1927, by monotypy.

Other references:

Plagiostropha – WELLS, 1991a: 26-29. — TAYLOR *et al.*, 1993: 163.
Clavus (*Plagiostropha*) – POWELL, 1966. — SHUTO, 1983: 293-295.

DIAGNOSIS. — *Shell* small, 8-20 mm, heavy, high spired, biconic. *Protoconch* paucispiral, small, of 2 whorls, smooth, globose. *Teleoconch* of up to 9 whorls. Strong axial pentagonal ribbing on most species, including the type species. Shell truncated, sinus very deep, margins elevated, on upper shoulder at 30° angle to shell axis. Outer lip strongly incurved, aperture narrow. Body whorl with pronounced low varix. Shell usually white.

Indo-Pacific; 95 to 410 m.

REMARKS. — This is a small group of claviform turrids characterized primarily by the strong pentagonal shape in transverse section. The relationship between *Plagiostropha* and *Clavus* has been uncertain. MELVILL (1927) described *Plagiostropha* as a separate genus. POWELL (1966) and SHUTO (1983) regarded *Plagiostropha* as a subgenus of *Clavus*. In a separate manner, SPRINGSTEEN & LEOBRERA (1986) placed a species of *Plagiostropha*, *P. opalus* (Reeve, 1845) in *Clavus* (*Clavus*). Most recently WELLS (1991a) and TAYLOR *et al.* (1993) recognised *Plagiostropha* as a valid genus. I believe the species of *Plagiostropha* can be separated at the generic level from *Clavus flammulatus* Montfort, 1810, the type species of *Clavus*, by their biconic shape, the strong varix on the left side of the body whorl, the lack of strong axial ribbing on the body whorl, the very deep sinus, the reflected lip, the narrow aperture, and the truncated body whorl. Almost all species of *Plagiostropha* have the characteristic pentagonal shape.

Source : MNHN, Paris

Plagiostropha turrita sp. nov.

Pl. 6, Figs 3-4

TYPE MATERIAL. — Holotype MNHN. Paratypes: 5 MNHN, 1 WAM 239-94.

TYPE LOCALITY. — New Caledonia, LAGON, stn 429, 22°40′ S, 167°15′ E, 95 m.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 429, 22°40′ S, 167°15′ E, 95 m, 1 dd (holotype). — Stn 872, 20°37′ S, 165°58′ E, 105 m, 1 dd (paratype). — Stn 937, 20°40′ S, 164°15′ E, 50-55 m, 12 dd. — Stn 942, 20°37′ S, 164°13′ E, 15 m, 1 dd. — Stn 972, 20°25′ S, 163°58′ E, 27 m, 1 dd (paratype). — Stn 995, 20°15′ S, 163°55′ E, 35-36 m, 1 dd (paratype). — Stn 1007, 20°12′ S, 163°52′ E, 23-24 m, 1 dd (paratype). — Stn 1024, 20°06′ S, 163°50′ E, 26 m, 6 dd (1 paratype WAM). — Stn 1171, 19°17′ S, 163°23′ E, 60 m, 1 dd. — Stn 1181, 19°24′ S, 163°15′ E, 45 m, 1 dd (paratype).

DISTRIBUTION. — New Caledonia in depths of from 15 to 105 m.

DESCRIPTION. — *Shell* small, 10 mm, high spired, conical, anterior end truncate, solid. *Protoconch* small, high, smooth, of 2 whorls, 0.85 mm high, 1.00 mm wide. *Teleoconch* of 8 angular whorls. Suture narrow but distinct, strongly undulating. Sculpture dominated by 5 very strong, narrow axial ribs which give shell a pentagonal shape. Ribs begin at upper suture and reach peak rapidly where remnant of previous sinus protrudes, giving whorl strong peak about 1/3 down whorl. Ribs extend to base of whorl and line up on adjacent whorls, except body whorl where they are offset. Two small axial ribs on body whorl, followed by strong varix just behind left face of whorl, no ribs on back of whorl. Entire shell surface, except protoconch, with distinct spiral cords, 11 on penultimate whorl, about 35 on body whorl, extending to anterior tip of shell, last six very strong. Spiral cords crossed by numerous axial growth lines giving shell a beaded appearance, some growth lines on body whorl very strong. Outer lip thickened, strongly incurved with broad, shallow stromboid notch on lower surface. Sinus very deep, at 45° angle to shell axis, margin thickened, entrance nearly sealed by strong callus and incurved outer lip, almost forming a circular tube. Aperture narrow, rectangular, deep. Columella narrow, smooth, slightly convex, margin strongly callused. Anterior canal short, broad, deep, anterior tip distinctly notched. Shell colour uniform glossy white.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	10.2	4.1	4.0	0.41	0.40
MNHN Paratype ($n=5$)					
Mean	13.2	5.4	5.4	0.41	0.41

REMARKS. — The upper whorls of *Plagiostropha turrita* have a turreted appearance which separates this species from all other species of *Plagiostropha*. The species is unique among the New Caledonian *Plagiostropha* in having numerous spiral cords and a beaded appearance. In addition, it can be easily separated from *P. hexagona* by the hexagonal shape of *P. hexagona*. *P. turrita* is also smaller in size (10 mm vs. 17 mm) and has a truncated anterior end. It can be distinguished from *P. costata* by its larger size (10 mm vs. 7.5 mm), and weaker varix on the body whorl. *Plagiostropha turrita* can be separated from *P. caledoniensis* by its smaller size (10 mm vs. 15 mm), broader shape, and lower spire, and in having a distinct varix on the body whorl.

ETYMOLOGY. — *Turrita* refers to the turreted upper whorls of this species.

Source : MNHN, Paris

Plagiostropha hexagona sp. nov.

Pl. 6, Figs 5-6

TYPE MATERIAL. — Holotype dd MNHN.

TYPE LOCALITY. — New Caledonia, SMIB 2, stn DW 23, 22°31′ S, 167°37′ E, 410-420 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* large for genus, 17 mm, biconic, very high spired, with a very long anterior canal. *Protoconch* low, presumably smooth but surface eroded after death, tip broken off, remaining protoconch of one whorl, 0.65 mm high, 0.35 mm wide. *Teleoconch* of 9 convex whorls, widest near the bottom of whorl. Suture adpressed, distinct, nearly straight. Dominant sculpture of strong, narrow, rounded axial ribs, 6 per whorl, giving shell a hexagonal shape. Subsutural area smooth, ribs begin about 1/3 down whorl, enlarge rapidly below the midpoint of the whorl, decrease, but reach lower suture. Ribs line up on lower whorls, but not on upper three whorls. Some very faint axial striae on upper surface of upper whorls, but in general whorl surface is smooth. Final axial rib on body whorl large, giving left face of body whorl a swollen appearance. Surface of body whorl smooth except for 4 faint axial ribs. Faint axial growth striae present. Outer lip thickened but heavily chipped. Sinus on outer shoulder large, very deep, entrance constricted by strong subsutural callus, margin of sinus thickened, strongly raised. Aperture narrow, elongate ovate, deep. Columella narrow, smooth, central area with bump, margin deeply callused. Anterior canal long, narrow, deep, anterior end curved to right. Shell colour uniform glossy white.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	17.4	6.8	7.7	0.39	0.44

REMARKS. — *Plagiostropha hexagona* is narrower and more elongate than all other *Plagiostropha*. It is distinctive among the New Caledonian *Plagiostropha* in having a hexagonal shape based on six strong axial ribs instead of the five usually found in the genus. It is also unusual in being narrow for the genus with a long, curving anterior canal.

ETYMOLOGY. — *Hexagona* refers to the six strong axial ribs which characterize this species.

Plagiostropha caledoniensis sp. nov.

Pl. 6, Figs 7-8

TYPE MATERIAL. — Holotype MNHN.

TYPE LOCALITY. — New Caledonia, P. Tirard coll., ca 22°40′ S to 22°50′ S, 167°10′ E to 167° 30′ E, 200-350 m.

MATERIAL EXAMINED. — Only known from the type locality.

DISTRIBUTION. — Only known from the type material.

DESCRIPTION. — *Shell* of medium size for genus, 15 mm, very high spired, narrow. *Protoconch* small, of 1.5 whorls, low rounded, dome shaped, surface smooth except for microscopic pitting, 0.39 mm high, 0.69 mm wide. *Teleoconch* of 9 convex whorls. Suture distinct, slightly undulating. Sculpture dominated by 5 strong narrow, ribs per whorl, giving shell a pentagonal shape. Ribs begin at upper suture, increase gradually until midwhorl, decrease but reach lower suture. Penultimate whorl high. Ribs become faint on penultimate whorl, slight rib on left face of body whorl giving left side a slightly swollen appearance. Except for this rib, surface of body whorl smooth with faint axial growth striations and spiral striae. Striae are faint, except for 15 slightly stronger striae near anterior tip of shell. Outer lip thickened, slightly incurved, with distinct notch on lower surface. Sinus on mid-shoulder, deep, entrance constricted by deep subsutural callus, at 45° angle to shell axis, margins thickened and slightly raised. Aperture subrectangular, narrow, deep. Columella of moderate width, slightly convex, smooth, margin callused with a strong notch outside anterior tip. Anterior canal short, broad, deep, anterior tip notched. Shell colour uniform light brown.

Source : MNHN, Paris

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	14.6	4.7	5.0	0.32	0.34

REMARKS. — The distinguishing features of *Plagiostropha caledonieusis* are the very high spire (higher than any other species of the genus), the narrow shape, and the absence of ribs on the penultimate whorl.

ETYMOLOGY. — *Caledoniensis* refers to the fact that this species is described from New Caledonia.

Plagiostropha costata sp. nov.

Pl. 6, Figs 9-10

TYPE MATERIAL. — Holotype MNHN. Paratypes: 57 lv and dd MNHN, 5 dd WAM 14-94.

TYPE LOCALITY. — West Indian Ocean, MD32 Réunion, stn DC 56, 21°05′ S, 55°12′ E. 170-225 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* small, 8 mm, high spired, truncate, broad. *Protoconch* small, globose, of 2 whorls, surface smooth with very fine microscopic pitting, 0.45-0.55 mm high, 0.70-75 mm wide. *Teleoconch* of 6 angular whorls. Suture thin, slightly undulating, distinct. Dominant sculpture of 5 strong, narrow ribs, giving shell a pentagonal shape. Ribs begin just below upper suture, enlarge rapidly, reach maximum above midwhorl, then decrease but reach lower suture. Ribs tend to angle to the right, and do not always line up on adjacent whorls. Ribs on body whorl not as strong except for rib on left face of body whorl, which is massive, giving a very strong swollen appearance to left side of body whorl. About 5 strong spiral striae at anterior tip of shell. Shell surface smooth except for faint axial growth striae and very fine microscopic pitting. Outer lip strongly thickened, strongly incurved with distinct stromboid notch on lower surface. Sinus very deep, end rounded, entrance constricted by distinct, but not strong callus. Aperture of moderate width, subrectangular, deep. Columella narrow, nearly straight, smooth, slightly callused. Anterior canal short, broad, of moderate depth, slightly notched. Shell colour uniform glossy white.

Measurements (mm):

	Length	Width	Aperture	W/L	A/L
Holotype	7.8	3.0	3.3	0.38	0.42
Paratypes ($n=15$)					
Mean	7.4	3.2	3.0	0.44	0.44
SD	0.2	0.3	0.2	0.04	0.04

REMARKS. — *Plagiostropha costata* is characterized by its small size, in having the left side of the face of the body whorl extremely swollen, and the fact that the axial ribs do not always match on adjacent whorls.

ETYMOLOGY. — *Costata* refers to the strong axial rib on the left side of the body whorl of this species.

Source : MNHN, Paris

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Source : MNHN, Paris

9

Deep-water Cones (Gastropoda: Conidae) from the New Caledonia region

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ABSTRACT

The New Caledonian species of *Conus* with a main distribution below 100 m are surveyed. This fauna consists of 39 species, of which 5 are new and 18 represent significant range extensions. In addition, eight species, mostly represented by single specimens, remain unidentified. Ten species (*Conus boucheti*, *C. kanakinus*, *C. luciae*, *C. plinthis*, *C. richeri*, and the five new ones) are so far only known from the New Caledonia region and may be endemic. *Conus smirna* and *C. profundorum* are regarded as distinct, and two additional species are described in this species complex: *C. vaubani* sp. nov., from South of New Caledonia and of the New Hebrides Arc in 440-775 m; and *C. loyaltiensis* sp. nov. from the Loyalty Islands in 480-575 m. Caledonia and of the New Hebrides Arc in 440-775 m; and *C. loyaltiensis* sp. nov. from the Loyalty Islands in 480-575 m. Three other new species, and one subspecies, are named: *Conus alisi* sp. nov. from the New Caledonia area, in 200-525 m; *C. estivali* sp. nov. from the Chesterfield Islands, Coral Sea, in 355-410 m; *C. gondwanensis* sp. nov. from the Norfolk Ridge, South New Caledonia, in 170-260 m; and *C. orbignyi coriolisi* ssp. nov., from the Coral Sea, New Caledonia and Loyalty Islands, in 225-550 m.

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RÉSUMÉ

Les cônes profonds (Gastropoda: Conidae) de la région néo-calédonienne.

Les cônes de la région néo-calédonienne sont examinés, en se limitant aux espèces vivant normalement à des profondeurs supérieures à 100 m. Cette faune comprend 39 espèces, dont 5 nouvelles et 18 signalées pour la première fois de ce secteur géographique, auxquelles s'ajoutent 8 espèces, pour la plupart représentées par des exemplaires uniques, laissées indéterminées. Dix espèces (*Conus boucheti*, *C. kanakinus*, *C. luciae*, *C. plinthis*, *C. richeri*, et les 5 espèces nouvelles) ne sont connues que de la région néo-calédonienne et peuvent actuellement être considérées comme endémiques. *Conus smirna* et *C. profundorum* sont traitées comme des espèces distinctes, et deux autres espèces sont décrites dans ce complexe : *C. vaubani* sp. nov., du Sud de la Nouvelle-Calédonie et de l'arc néo-hébridais par 440-775 m; et *C. loyaltiensis* sp. nov., des îles Loyauté par 480-575 m. Trois autres espèces et une sous-espèce nouvelles sont décrites : *Conus alisi* sp. nov., de Nouvelle-Calédonie par 200-525 m ; *C. estivali* sp. nov. des îles Chesterfield, en mer du Corail, par 355-410 m ; *C. gondwanensis* sp. nov. de la Ride de Norfolk, au Sud de la Nouvelle-Calédonie, par 170-260 m ; et enfin *C. orbignyi coriolisi* ssp. nov., de la mer du Corail, de Nouvelle-Calédonie et des îles Loyauté par 225-550 m.

INTRODUCTION

The species of the family Conidae of New Caledonia were listed and illustrated by ESTIVAL (1981) in a review focussing on the species collected intertidally or by SCUBA. Exploratory dredgings in 1978-1979 revealed the existence of a rich and largely undescribed deep-sea fauna, including two new species of *Conus* (RICHARD, 1983). Since 1984, several expeditions and dredging programmes have generated an outstanding collection of shallow and deep-sea molluscs from the waters surrounding New Caledonia and its satellite islands and reefs. Narratives of these cruises and station lists were compiled by RICHER DE FORGES (1990, 1991, 1993).

Of these cruises, CHALCAL 1, MUSORSTOM 5 and CORAIL 2 surveyed the seamounts and banks of the Lord Howe Ridge, inclusive of the partly emerged Chesterfield plateau, in the Coral Sea. The Norfolk Ridge, south of the Isle of Pines, has been sampled by the largest number of expeditions: BIOCAL (in part), MUSORSTOM 4 (in part), CHALCAL 2, SMIB 1-5, SMIB 8 and BERYX 11. BIOCAL (in part), BIOGEOCAL, MUSORSTOM 6 and CALSUB explored the slopes of the Loyalty basin and the Loyalty Ridge. The area North of the New Caledonia mainland, known as "Grand Passage", was surveyed during MUSORSTOM 4 (in part) and SMIB 6. Finally, the volcanic islands of Hunter and Matthew, on the westernmost rim of the Pacific plate, were sampled by the VOLSMAR expedition. As a result, new species of *Conus* were described by MOOLENBEEK (1986), RICHARD & MOOLENBEEK (1988), RÖCKEL, KORN & RICHARD (1993), and new records were presented by RICHER DE FORGES & ESTIVAL (1986).

This paper summarizes already published records on the deep-water *Conus* of the New Caledonia region, and presents many additions. The distinction between shallow and deep-water fauna has been arbitrarily placed at about 100 m, *i.e.* only species with their main distribution below 100 m are treated. Another paper will present and discuss new records of shallow-water species. Unless otherwise stated the material is in MNHN. In contrast with collections of shallow-water cones, the present material contains a rather high proportion of shells with well preserved protoconchs, even in adults of small to medium-sized species. Therefore, we have used protoconch characters in the descriptions of new taxa, even when similar data for already named species are unknown. Additional protoconch data will be presented in a forthcoming monograph on the Indo-Pacific species of *Conus*.

The taxonomy of higher taxa in the family Conidae is still far from settled. DA MOTTA (1991) introduced a new, controversial genus-level classification of the family, recognizing many new subgenera. Until this classification has been thoroughly evaluated, we prefer to use a single genus *Conus*, in its traditional, conservative, acceptance. For pragmatic reasons we use alphabetical order in species treatment.

Source : MNHN, Paris

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

AMS : Australian Museum, Sydney
BMNH : The Natural History Museum, London
DR : Dieter Röckel's collection, to be deposited in the Staatliches Museum für Naturkunde, Stuttgart
MNHN : Muséum national d'Histoire naturelle, Paris
NMNZ : Museum of New Zealand Te Papa Tongarewa, Wellington
ZMA : Zoölogisch Museum, Amsterdam

Other abbreviations

D : Diameter
H : Height
L : Length
RD : Relative diameter of last whorl (maximum diameter of last whorl/aperture height)
RSH : Relative spire height (shell length minus aperture height/aperture height)
W : Width
spm : specimen(s), doubtful if alive or dead collected
lv : live collected specimen(s)
dd : dead collected specimen(s).

SYSTEMATIC ACCOUNT

Family CONIDAE Fleming, 1822

Genus ***Conus*** Linné, 1758

Conus alisi Moolenbeek, Röckel & Richard sp. nov.

Figs 2, 4-5

Conus sp. C – RICHER DE FORGES & ESTIVAL, 1986: 16. figs.

TYPE MATERIAL. — Holotype MNHN. Paratypes: 2 MNHN, 1 ZMA 3.94.024, 1 NMNZ M268539, 1 AMS C201716, 1 DR.

TYPE LOCALITY. — Norfolk Ridge, SMIB 8, stn DW 183, 23°18′ S, 168°05′ E. 330-367 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 162, 18°35′ S, 163°10′ E, 525 m, 1 dd. — Stn DW 163, 18°34′ S, 163°11′ E, 350 m, 2 dd. — Stn DW 164, 18°33′ S, 163°13′ E, 255 m, 1 dd. — Stn DW 181, 18°57′ S, 163°22′ E, 350 m, 5 dd. — Stn DW 196, 18°55′ S, 163°24′ E, 450 m, 4 dd. — Stn DW 230, 22°52′ S, 167°12′ E, 390-420 m, 1 lv.
SMIB 1: stn DW 2, 22°52′ S, 167°13′ E, 415 m, 1 dd.
SMIB 2: stn DW 3, 22°56′ S, 167°15′ E, 412-428 m, 4 dd. — Stn DW 5, 22°56′ S, 167°14′ E, 398-410 m, 2 dd. — Stn DW 8, 22°54′ S, 167°12′ E, 435-447 m, 1 dd. — Stn DW 17, 22°51′ S, 167°14′ E, 428-448 m, 1 dd.
SMIB 3: stn DW 10, 24°42′ S, 168°07′ E, 235 m, 2 spms. — Stn DW 14, 23°40′ S, 168°00′ E, 246 m, 11 dd. — Stn DW 18, 23°42′ S, 167°59′ E, 338 m, 7 dd.

Source : MNHN, Paris

FIGS 1-3. - Protoconchs. — **1**, *Conus loyaltiensis*, MUSORSTOM 6: stn CP 467. — **2**, *C. alisi*, SMIB 8: stn DW 189. - **3**, *C. vaubani*, BIOCAL: stn DW 46. Scale lines 0.5 mm.

SMIB 4: stn DW 50, 23°42′ S, 168°01′ E, 260-295 m, 6 dd. — Stn DW 53, 23°40′ S, 168°00′ E, 250-270 m, 7 spms. — Stn DW 55, 23°21′ S, 168°04′ E, 215-260 m, 1 dd. — Stn DW 56, 23°21′ S, 168°05′ E, 230-260 m, 1 dd. — Stn DW 65, 22°55′ S, 167°14′ E, 400-420 m, 1 dd. — Stn DW 67, 22°51′ S, 167°16′ E, 450-460 m, 1 lv.

SMIB 5: stn DW 72, 23°42′ S, 168°01′ E, 400 m, 8 spms. — Stn DW 73, 23°41′ S, 168°01′ E, 240 m, 2 dd. — Stn DW 75, 23°41′ S, 168°01′ E, 270 m, 5 spms. — Stn DW 76, 23°41′ S, 168°00′ E, 280 m, 2 dd. — Stn DW 80, 23°42′ S, 168°00′ E, 300 m, 2 dd. — Stn DW 89, 22°19′ S, 168°41′ E, 265-295 m, 1 dd. — Stn DW 97, 23°01′ S, 168°18′ E, 300 m, 1 dd. - Stn DW 98, 23°02′ S, 168°16′ E, 335 m, 7 dd. — Stn DW 101, 23°21′ S, 168°05′ E, 270 m, 6 dd. — Stn DW 102, 23°20′ S, 168°05′ E, 305 m, 3 dd. — Stn DW 104, 23°16′ S, 168°04′ E, 335 m, 2 dd. — Stn DW 105, 23°14′ S, 168°04′ E, 310 m, 2 dd.

SMIB 6: stn DW 121, 18°58′ S, 163°26′ E, 315 m, 5 dd. — Stn DW 122, 18°58′ S, 163°25′ E, 325-330 m, 1 dd.

SMIB 8: stn DW 156, 24°46′ S, 168°08′ E, 275-300 m, 1 dd. — Stn DW 159, 24°46′ S, 168°08′ E, 241-245 m, 1 spm. — Stn DW 171, 23°40′ S, 168°01′ E, 233-250 m, 1 dd. — Stn DW 170-172, 23°41′ S, 168°01′ E, 233-290 m, 1 lv (paratype AMS, 18.8 × 10 mm), 7 dd (1 paratype MNHN, 19.7 × 10.4 mm). — Stn DW 177, 23°39′ S, 168°00′ E, 320-370 m, 5 dd (1 paratype ZMA, 20.7 × 11.8 mm), 1 lv (paratype NMNZ, 20.2 × 11.1 mm). — Stn DW 174, 23°40′ S, 168°01′ E, 235-240 m, 1 dd. — Stn DW 178, 23°46′ S, 168°17′ E, 400 m, 1 dd. — Stn DW 179, 23°47′ S, 168°17′ E, 400-405 m, 2 dd. — Stn DW 181, 23°18′ S, 168°05′ E, 311-330 m, 1 dd (paratype DR, 17.7 × 9.2 mm). — Stn DW 182, 23°19′ S, 168°05′ E, 314-330 m, 7 dd. — Stn DW 183, 23°18′ S, 168°05′ E, 330-367 m, 1 spm (holotype). — Stn DW 182-184, 23°18′ S, 168°05′ E, 305-367 m, 3 dd (1 paratype MNHN, 17.6 × 9.2 mm). — Stn DW 185, 23°16′ S, 168°04′ E, 311-355 m, 1 dd. — Stn DW 189, 23°18′ S, 168°06′ E, 400-402 m, 6 dd. — Stn DW 198, 22°52′ S, 168°13′ E, 414-430 m, 1 dd.

BIOCAL: stn DW 38, 23°00′ S, 167°15′ E, 360 m, 2 dd. — Stn CP 45, 22°47′ S, 167°15′ E, 430-465 m, 2 dd. — Stn DW 64, 24°48′ S, 168°09′ E, 250 m, 2 dd.

LAGON: stn 444, 18°15′ S, 162°59′ E, 300-350 m, 5 dd.

CHALCAL 2: stn DW 71, 24°42′ S, 168°10′ E, 230 m, 1 dd. — Stn DW 78, 23°41′ S, 168°00′ E, 233 m, 2 spms. — Stn DW 81, 23°20′ S, 168°03′ E, 311 m, 1 spm. — Stn DW 82, 23°14′ S, 168°04′ E, 304 m, 1 dd. — Stn DW 83, 23°20′ S, 168°05′ E, 200 m, 1 spm.

Loyalty Islands. MUSORSTOM 6: stn DW 472, 21°09′ S, 167°55′ E, 300 m, 1 dd.

BIOGEOCAL: stn KG 252, 21°31′ S, 166°22′ E, 330 m, 1 dd.

Source : MNHN, Paris

FIGS 4-15. — Endemic deep-sea cones of New Caledonia. — **4-5,** *Conus alisi*, holotype, 22.2 × 12.3 mm. — **6-7,** *C. estivali*, holotype, 10.4 × 6.0 mm. — **8-9,** *C. gondwanensis*, holotype, 21.4 × 11.6 mm. — **10-11,** *C. loyaltiensis*, holotype, 21.8 × 10.1 mm. — **12-13,** *C. orbignyi coriolisi*, holotype, 44.6 × 16.0 mm. — **14-15,** *C. vaubani*, holotype, 25.8 × 11.7 mm.

Source : MNHN, Paris

DISTRIBUTION. — Southern New Caledonia, Norfolk Ridge and Loyalty Islands, in 200-525 m; alive in 290-460 m.

DESCRIPTION. — Holotype length 22.2 mm, width 12.3 mm; aperture height 19.3 mm. *Shell* small, low biconic, slightly pyriform, fragile. *Protoconch*, diameter 1.1 mm, pointed and shiny, 3.2 convex whorls, initial part missing. Colour of protoconch opaque white with a peculiar brown blotch on second whorl. *Teleoconch consists* of 6.0 whorls, spire slightly stepped. First teleoconch whorl with two spiral grooves, gradually increasing to 3 on the last spire whorl; grooves rather strong. Whorls slightly stepped with a strong, smooth adapical rim above suture. Outline of spire slightly convex. Body whorl slightly pyriform with about 11 spiral grooves at the base. Sculpture smooth with very fine hardly visible spiral striae. Aperture straight, rather wide, outer lip thin. Colour light violet-grey, with about 18 spiral rows of very fine brown spots; in the middle an irregular band of white and brown cloudy blotches. Smaller white blotches are situated on the upper part. Shoulder rim white, with 12 brown spots. These spots are also visible on the earlier whorls.

REMARKS. — Paratypes and other specimens of *Conus alisi* attain a shell length of 30 mm, their relative diameter ranges from 0.62-0.68 and the relative spire height from 0.13-0.18. The colour is often pure white, but sometimes light orange or violet-grey, with irregular and cloudy white and brown spots and often also with spiral lines of brown dots.

Conus alisi is very similar to *C. dayriti* Röckel & Da Motta, 1983. *C. alisi* can be distinguished mainly by its larger (maximum diameter 1.1 mm vs 0.80-0.95 mm) and differently coloured (white with a brown blotch vs light brown) protoconch, slightly stepped spire whorls, stronger spiral grooves on spire whorls, and its often pure white colouration.

ETYMOLOGY. — The new species is named after R.V. *"Alis"*, the vessel used for ORSTOM cruises since 1988.

Conus aphrodite Petuch, 1979

Fig. 25

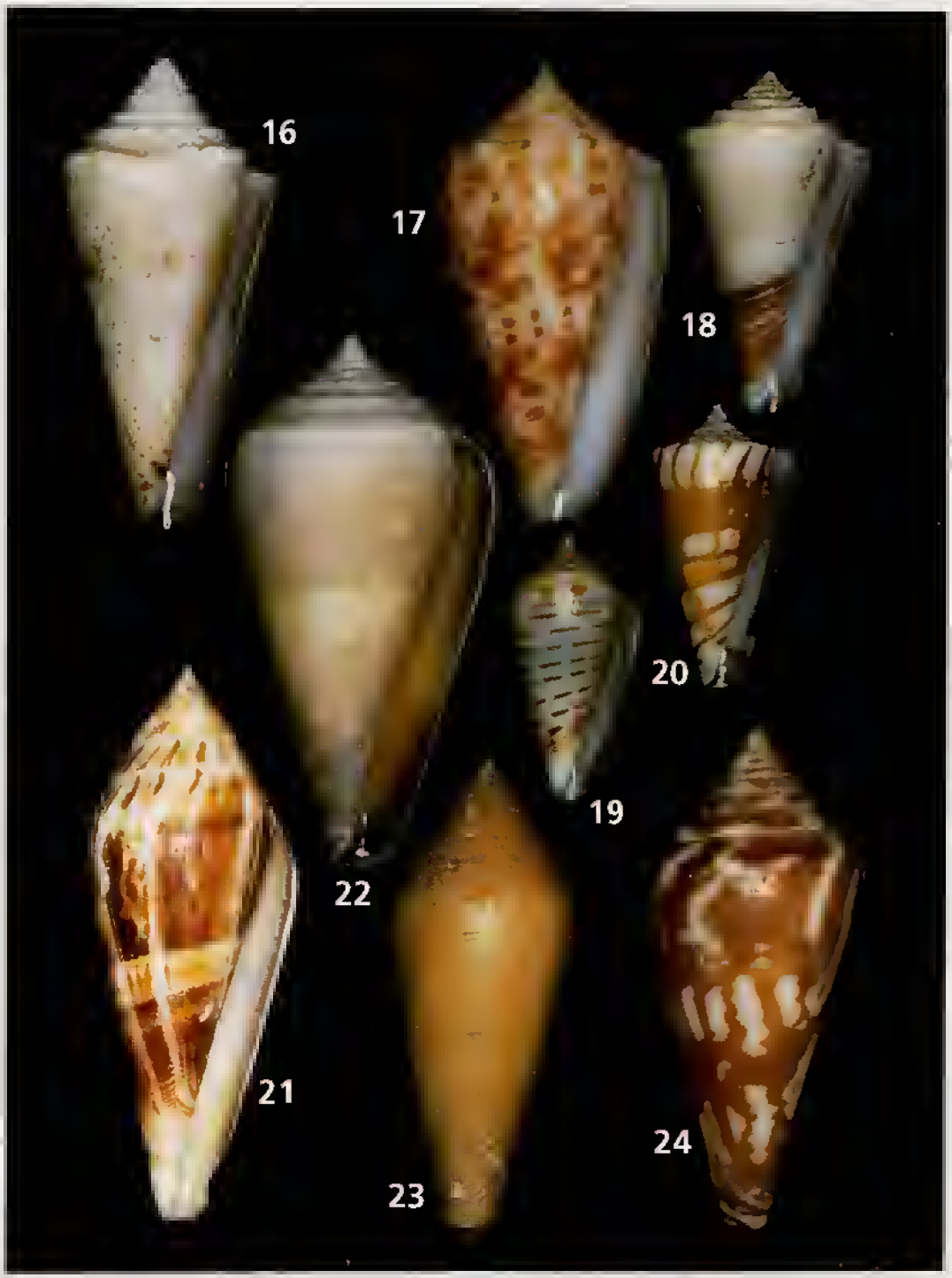
Conus aphrodite Petuch, 1979: 11, 17, figs 34-35.
Conus aphrodite — COOMANS *et al.*, 1981: 4, fig. 107.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 872, 20°37′ S, 165°58′ E, 105 m, 2 dd.
MUSORSTOM 4: stn DW 163, 18°34′ S, 163°11′ E, 350 m, 1 dd.
SMIB 4: stn DW 53, 23°40′ S, 168°00′ E, 250-270 m, 1 dd.
SMIB 5: stn DW 70, 23°41′ S, 168°01′ E, 270 m, 1 dd. — Stn DW 87, 22°19′ S, 168°41′ E, 370 m, 1 dd. — Stn DW 92, 22°20′ S, 168°41′ E, 280 m, 2 dd. — Stn DW 93, 22°20′ S, 168°42′ E, 255 m, 2 dd. — Stn DW 97, 23°01′ S, 168°18′ E, 300 m, 1 dd.
SMIB 8: stn DW 170-172, 23°41′ S, 168°01′ E, 233-290 m, 2 dd. — Stn DW 175, 23°41′ S, 168°01′ E, 235-240 m, 1 spm.
Loyalty Islands. MUSORSTOM 6: stn DW 418, 20°42′ S, 167°03′ E, 283 m, 1 dd. — Stn DW 451, 20°59′ S, 167°25′ E, 330 m, 8 dd. — Stn DW 480, 21°08′ S, 167°56′ E, 380 m, 1 spm.
New Hebrides Arc. VOLSMAR: stn DW 40, 22°20′ S, 168°41′ E, 275-295 m, 1 dd.
GEMINI: stn DW 59, 21°00′ S, 170°17′ E, 320 m, 1 dd.

DISTRIBUTION. — Southern Japan (Ryukyu Is.) and Philippines; now New Caledonia, in 105-380 m (dead).

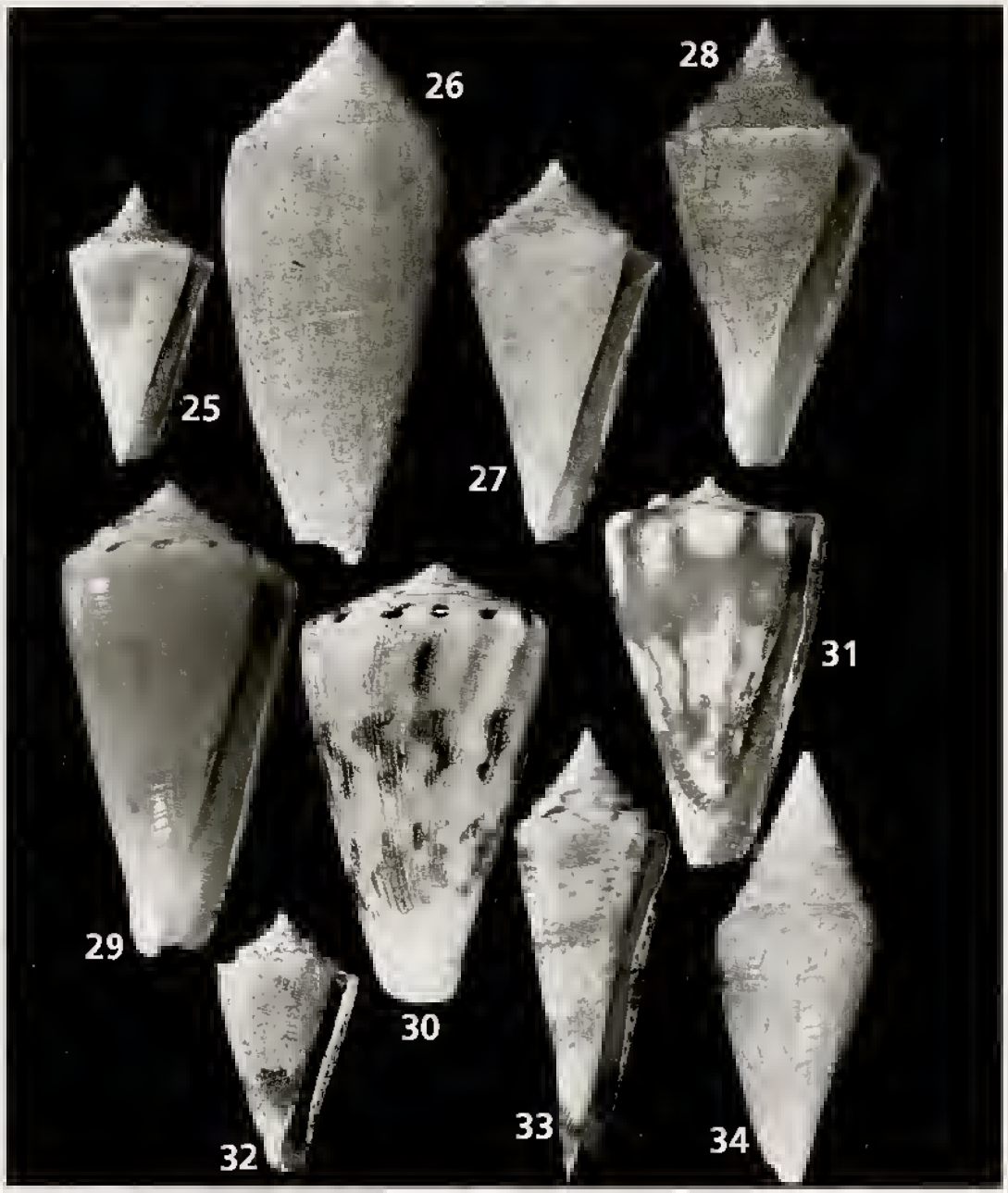
REMARKS. — This is the first record from Melanesia. The colour pattern is faded due to the fact that all specimens were dead when collected. The largest shell has a length of 19 mm.

Source : MNHN, Paris



FIGS 16-24. — Endemic and other deep-sea cones of New Caledonia. — **16**, *Conus luciae*, Coral Sea, 55.9 × 24.1 mm. — **17**, *C. richeri*, New Caledonia, 53.8 × 26.2 mm. — **18**, *C. boucheti*, New Caledonia, 24 × 12.8 mm. — **19**, *C. kanakinus*, South New Caledonia, 17.7 × 8.7 mm. — **20**, *C. plinthis*, Loyalty Islands, 21.3 × 9.5 mm. — **21**, *C. suirna*, South New Caledonia, 75.0 × 30.0 mm. — **22**, *C. profundorum*, Loyalty Islands, 65.0 × 33.0 mm.. — **23**, *C. lani*, Loyalty Islands, 54.2 × 22.3 mm. — **24**, *C. darkini*, Loyalty Islands, holotype, 55.7 × 24.4 mm.

Source : MNHN, Paris



FIGS 25-34. — **25**, *Conus aphrodite*, South of Vanuatu, GEMINI: stn DW 59, 16.7 × 8.7 mm. — **26**, *Conus armadillo*, Loyalty Islands, MUSORSTOM 6: stn DW 428, 54.2 × 22.4 mm. — **27**, *Conus baileyi*, Loyalty Islands, MUSORSTOM 6: stn DW 451, 24.0 × 12.4 mm. — **28**, *Conus boholensis*, New Caledonia, BIOCAL: stn CP 108, 29.5 × 14.5 mm. — **29**, *Conus bruuni*, New Caledonia, CALSUB: pl. 21, 65.3 × 33.1 mm. — **30**, *Conus bruuni*, Loyalty Islands, MUSORSTOM 6: stn DW 417, 48.9 × 29.2 mm. — **31**, *Conus capitanellus*, South New Caledonia, BERYX 11: stn CP 21, 31.6 × 18 mm. — **32**, *Conus chiangi*, New Caledonia, Norfolk Ridge, SMIB 5: stn DW 158, 13.7 × 7.7 mm. — **33**, *Conus comatosa*, Loyalty Islands, MUSORSTOM 6: stn DW 453, 41.6 × 14.6 mm. — **34**, *Conus excelsus*, Loyalty Islands, MUSORSTOM 6: stn DW 391, 43.5 × 13.3 mm.

Source : MNHN, Paris

Conus armadillo Shikama, 1971

Fig. 26

Conus (Asprella) armadillo Shikama, 1971: 34, fig. 2.
Conus armadillo — Coomans *et al.*, 1981: 19, figs 99, 133.

Material examined. — **Loyalty Islands**. musorstom 6: stn DW 428, 20°24′ S, 166°13′ E, 420 m, 1 dd.

Distribution. — Taiwan, Philippines, East Australia, and now New Caledonia, in 420 m (dead).

Remarks. — This is the first record of *C. armadillo* from Melanesia. The specimen from Loyalty Islands has a length of 53 mm, smaller than those from the Philippines which vary from 60 to 79 mm.

Conus baileyi Röckel & Da Motta, 1979

Fig. 27

Conus baileyi Röckel & Da Motta, 1979: 9, text figs
Conus baileyi — Coomans *et al.*, 1982: 6, figs 177, 189. — Richer de Forges & Estival, 1986: 16.

Material examined. — **Chesterfield Islands**. musorstom 5: stn DW 280, 24°10′ S, 159°36′ E, 270 m, 1 dd.
New Caledonia. lagon: stn 387, 22°39′ S, 167°07′ E, 225 m, 4 dd. — Stn 396, 22°40′ S, 167°09′ E, 284 m, 2 dd. — Stn 539, 19°05′ S, 163°17′ E, 230-240 m, 1 dd.
musorstom 4: stn DW 204, 22°37′ S, 167°06′ E, 120 m, 1 dd. — Stn DW 208, 22°40′ S, 167°08′ E, 275-280 m, 3 dd. — Stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 1 dd.
Loyalty Islands. musorstom 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 1 dd. — Stn DW 392, 20°47′ S, 167°05′ E, 340 m, 2 dd. — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 3 dd. — Stn DW 399, 20°42′ S, 167°00′ E, 282 m, 1 spm. — Stn DW 417, 20°42′ S, 167°04′ E, 283 m, 1 dd. — Stn DW 418, 20°42′ S, 167°03′ E, 283 m, 1 spm. — Stn DW 423, 20°26′ S, 166°41′ E, 280 m, 1 dd. — Stn DW 451, 20°59′ S, 167°25′ E, 330 m, 1 spm. — Stn DW 453, 21°00′ S, 167°27′ E, 250 m, 2 dd. — Stn DW 462, 21°05′ S, 167°27′ E, 200 m, 4 dd. — Stn DW 481, 21°22′ S, 167°50′ E, 300 m, 1 dd. — Stn DW 485, 21°23′ S, 167°59′ E, 350 m, 1 dd. — Stn DW 487, 21°23′ S, 167°46′ E, 500 m, 1 dd.
smib 6: stn DW 113, 19°03′ S, 163°30′ E, 250 m, 1 dd. — Stn DW 126, 18°59′ S, 163°23′ E, 320-330 m, 1 dd. — Stn DW 130, 19°05′ S, 163°21′ E, 225-230 m, 1 dd. — Stn DW 132, 19°03′ S, 163°19′ E, 235-240 m, 1 dd.

Distribution. — Solomon Islands, Queensland, and New Caledonia, in 120-440 m (dead).

Remarks. — *Conus baileyi* resembles to *C. memiae* Habe & Kosuge, 1960, but can be distinguished by its broader and often pyriform last whorl and different colour pattern. Another similar taxon is *C. nereis* Petuch, 1979 from the Philippines, provisionally considered a local form of *C. wakayamaensis* (Kuroda, 1956). *Conus nereis* has a broader last whorl, a less carinate shoulder, and lacks the distinct spiral grooves on the ultimate spire whorl.

Length of specimens from New Caledonia and Loyalty Islands ranges from 20 to 24 mm.

Source : MNHN, Paris

Conus boholensis Petuch, 1979

Fig. 28

Conus boholensis Petuch, 1979: 12, figs 20-21.
Conus boholensis — Coomans *et al.*, 1982: 32, figs 175, 250.

Material examined. — **Chesterfield Islands**. musorstom 5: stn DC 381, 19°38′ S, 158°47′ E, 620 m, 1 dd.
New Caledonia. *"Vauban"* 1978-79: stn 39, 22°29′ S, 166°23′ E, 375-550 m, 1 dd.
biocal: stn CP 108, 22°03′ S, 167°06′ E, 335 m, 3 lv, 1 dd.
musorstom 4: stn CC 246, 22°08′ S, 167°11′ E, 410-420 m, 3 lv.
Coll. Tirard: 22°40′ S, 167°10′ E, 200-350 m, 1 dd.
Loyalty Islands. biogeocal: stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 1 dd.
musorstom 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 2 dd. — Stn DW 393, 20°48′ S, 167°10′ E, 420 m, 3 dd. — Stn DW 397, 20°47′ S, 167°05′ E, 380 m, 1 spm. — Stn DW 406, 20°41′ S, 167°07′ E, 373 m, 4 dd. — Stn DW 411, 20°41′ S, 167°03′ E, 424 m, 8 dd. — Stn DW 413, 20°40′ S, 167°03′ E, 463 m, 3 dd. — Stn DW 428, 20°24′ S, 166°13′ E, 420 m, 7 dd.

Distribution. — Philippines, South Vietnam, North West Australia, North Somalia; now New Caledonia, in 310-620 m, alive in 335-420 m.

Remarks. — This is the first record of *C. boholensis* from Melanesia. Coomans *et al.* (1982) considered *C. boholensis* a synonym of *C. borneensis* Adams & Reeve, 1848. However, the lectotype of *C. borneensis*, in bmnh, has a broader last whorl (RD 0.67 vs. 0.57-0.63 in *C. boholensis*), its spire outline is concave and the adapical part of its last whorl is smooth. The lectotype of *Conus borneensis* was found in a depth of 18 m [10 fms], and there has been no additional bathymetrical data in the literature. Provisionally, we consider *C. boholensis* a valid species.

The largest specimen measures 30 × 15 mm.

Conus boucheti Richard, 1983

Fig. 18

Conus boucheti Richard, 1983: 53, 57, figs 1-4.

Material examined. — **Chesterfield Islands**. musorstom 5: stn DW 301, 22°07′ S, 159°25′ E, 487-610 m, 4 dd. — Stn DW 305, 22°09′ S, 159°24′ E, 430-440 m, 1 dd. — Stn DW 306, 22°08′ S, 159°21′ E, 375-415 m, 1 dd. — Stn DC 372, 19°53′ S, 158°39′ E, 400 m, 1 dd. — Stn DC 381, 19°38′ S, 158°47′ E, 620 m, 1 dd.
corail 2: stn DE 16, 20°48′ S, 160°56′ E, 500 m, 1 lv.
New Caledonia. *"Vauban"* 1978-79, 22°50′ S, 167°15′ E, 400 m (holotype and 4 paratypes).
biocal: stn DW 82, 20°31′ S, 166°50′ E, 440-460 m, 1 dd.
musorstom 4: stn DW 162, 18°35′ S, 163°10′ E, 525 m, 1 dd. — Stn CC 175, 18°59′ S, 163°17′ E, 370 m, 1 dd. — Stn DW 222, 22°58′ S, 167°37′ E, 410-440 m, 1 dd. — Stn DW 223, 22°57′ S, 167°30′ E, 545-560 m, 2 dd. — Stn DW 226, 22°47′ S, 167°22′ E, 390 m, 1 dd. — Stn CC 246, 22°08′ S, 167°11′ E, 410-420 m, 1 dd.
smib 2: stn DW 20, 22°44′ S, 167°42′ E, 415-470 m, 1 dd. — Stn DW 21, 22°40′ S, 167°41′ E, 460-500 m, 2 dd. — Stn DW 23, 22°31′ S, 167°36′ E, 410-420 m, 1 dd.
smib 3: stn DW 16, 23°41′ S, 168°00′ E, 426 m, 1 dd.
smib 5: stn DW 87, 22°19′ S, 168°41′ E, 370 m, 1 dd.
smib 8: stn DW 160, 24°46′ S, 168°08′ E, 280-282 m, 2 dd. — Stn DW 189, 23°18′ S, 168°06′ E, 400-402 m, 16 dd, 4 lv.

Source : MNHN, Paris

BERYX 11: stn DW 11, 24°44′ S, 168°10′ E, 320-350 m, 8 dd. — Stn CP 21, 24°44′ S, 168°07′ E, 430-450 m, 3 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 392, 20°47′ S, 167°05′ E, 340 m, 1 dd. — Stn DC 402, 20°30′ S, 166°49′ E, , 520 m, 8 dd. — Stn DW 407, 20°41′ S, 167°07′ E, 360 m, 1 dd. — Stn DW 411, 20°41′ S, 167°03′ E, 424 m, 2 dd. — Stn DW 413, 20°40′ S, 167°03′ E, 463 m, 8 dd. — Stn DW 416, 20°42′ S. 167°00′ E, 343 m, 1 dd. — Stn DW 428, 20°24′ S, 166°13′ E, 420 m, 1 dd. — Stn DW 457, 21°00′ S, 167°29′ E, 353 m, 3 dd. — Stn DW 458, 21°01′ S, 167°30′ E, 400 m, 1 dd. — Stn DW 459, 21°01′ S, 167°31′ E, 425 m, 37 dd, 1 lv. — Stn DW 460, 21°02′ S, 167°31′ E, 420 m, 9 dd. — Stn DW 464, 21°02′ S, 167°32′ E, 430 m, 9 dd. — Stn DW 487, 21°23′ S, 167°46′ E, 500 m, 9 dd.
New Hebrides Arc. GEMINI: stn DW 51, 20°58′ S, 170°03′ E, 450 m, 2 dd.

DISTRIBUTION. – Apparently restricted to the SW Pacific, from the Coral Sea (Chesterfield Islands) through New Caledonia to the New Hebrides Arc, in 280-620 m, alive in 400-500 m.

Dimensions of the largest specimen 27 × 14.5 mm.

Conus bruuni Powell, 1958

Figs 29-30

Conus bruuni Powell, 1958: 84, pl. 10, fig. 3.
Conus bruuni – COOMANS *et al.*, 1982: 45, figs 184, 268. — DAVENPORT, 1991: 7.
Conus kinoshitai – RICHER DE FORGES & ESTIVAL, 1986: 16.

MATERIAL EXAMINED. — **Chesterfield Islands**. CHALCAL 1: stn DC 64, 22°11′ S, 159°15′ E, 305 m, 1 dd.
MUSORSTOM 5: stn DW 260, 25°29′ S, 159°44′ E, 285 m, 1 dd. — Stn CP 276, 24°49′ S, 159°41′ E, 269-258 m, 1 dd. — Stn DW 277, 24°11′ S, 159°35′ E, 270 m, 1 dd. — Stn DW 304, 22°10′ S, 159°26′ E, 385-420 m, 1 dd.
New Caledonia. CHALCAL 2: stn CP 18, 24°47′ S, 168°09′ E, 274 m, 3 lv. — Stn DW 71, 24°42′ S, 168°10′ E, 230 m, 3 spms. — Stn CH 5, 24°44′ S, 168°09′ E, 223 m, 1 spm. — Stn DW 78, 23°41′ S, 168°00′ E, 233 m, 1 dd. — Stn DW 79, 23°40′ S, 168°00′ E, 243 m, 3 dd. — Stn DW 81, 23°20′ S, 168°03′ E, 311 m, 1 lv. — Stn DW 82, 23°14′ S, 168°04′ E, 304 m, 1 spm. — Stn DW 83, 23°20′ S, 168°05′ E, 200 m, 1 spm. — Stn DW 84, 23°24′ S, 168°07′ E, 170 m, 1 dd.
SMIB 3: stn DW 8, 24°45′ S, 168°08′ E, 233 m, 3 dd. — Stn DW 9, 24°42′ S, 168°08′ E, 265 m, 1 dd. — Stn DW 10, 24°42′ S, 168°07′ E, 235 m, 1 spm. — Stn DW 14, 23°40′ S, 168°00′ E, 246 m, 8 spms. — Stn DW 16, 23°41′ S, 168°00′ E, 426 m, 1 dd. — Stn DW 18, 23°42′ S, 167°59′ E, 338 m, 31 dd. — Stn DW 20, 23°40′ S, 168°00′ E, 280 m, 13 spms. — Stn DW 28, 22°47′ S, 167°12′ E, 394 m, 1 spm.
SMIB 4: stn DW 43, 24°47′ S, 168°09′ E, 235-245 m, 1 spm. — Stn DW 44, 24°46′ S, 168°08′ E, 270-300 m, 1 spm. — Stn DW 46, 24°47′ S, 168°08′ E, 245-260 m, 2 spms. — Stn DW 47, 24°46′ S, 168°08′ E, 250-280 m, 4 spms. — Stn DW 49, 24°45′ S, 168°08′ E, 240-300 m, 3 spms. — Stn DW 50, 23°42′ S, 168°01′ E, 260-295 m, 6 dd. — Stn DW 51, 23°41′ S, 168°01′ E, 245-260 m, 11 spms. — Stn DW 52, 23°41′ S, 168°00′ E, 235-250 m, 2 spms. — Stn DW 53, 23°40′ S, 168°00′ E, 250-270 m, 24 lv. — Stn DW 54, 23°40′ S, 168°00′ E, 230-235 m, 7 dd. — Stn DW 56, 23°21′ S, 168°05′ E, 230-260 m, 2 dd. — Stn DW 57, 23°21′ S, 168°05′ E, 210-260 m, 1 dd.
SMIB 5: stn DW 70, 23°41′ S, 168°01′ E, 270 m, 8 dd. — Stn DW 71, 23°41′ S, 168°01′ E, 265 m, 7 dd. — Stn DW 72, 23°42′ S, 168°01′ E, 400 m, 4 dd. — Stn DW 73, 23°41′ S, 168°01′ E, 240m, 8 dd. — Stn DW 74, 23°40′ S, 168°01′ E, 245 m, 2 dd. — Stn DW 75, 23°41′ S, 168°01′ E, 270 m, 8 dd. — Stn DW 76, 23°41′ S, 168°00′ E, 280 m, 1 lv, 5 spms. — Stn DW 77, 23°41′ S, 168°01′ E, 270 m, 2 dd. — Stn DW 78, 23°41′ S, 168°00′ E, 245 m, 1 dd. — Stn DW 79, 23°41′ S, 168°01′ E, 285 m, 4 dd. — Stn DW 80, 23°42′ S, 168°00′ E, 300 m, 1 dd. — Stn DW 87, 22°19′ S, 168°41′ E, 370 m, 1 dd. — Stn DW 89, 22°19′ S, 168°41′ E, 295 m, 1 dd. — Stn DW 91, 22°18′ S, 168°41′ E,

Source : MNHN, Paris

340 m, 2 dd. — Stn DW 92, 22°20′ S, 168°41′ E, 280 m, 1 dd. — Stn DW 93, 22°20′ S, 168°42′ E, 255 m, 1 dd. — Stn DW 94, 22°20′ S, 168°43′ E, 275 m, 3 dd.
SMIB 6: stn DW 110, 19°05′ S, 163°30′ E, 225-230 m, 1 dd. — Stn DW 112, 19°06′ S, 163°30′ E, 220-225 m, 1 dd. — Stn DW 113, 19°03′ S, 163°30′ E, 250 m, 1 dd. — Stn DW 128, 19°06′ S, 163°22′ E, 205-215 m, 1 dd.
SMIB 8: stn DW 154, 24°46′ S, 168°08′ E, 235-252 m, 1 dd. — Stn DW 155, 24°46′ S, 168°08′ E, 257-262 m, 3 dd. — Stn DW 156, 24°46′ S, 168°08′ E, 275-300 m, 8 dd. — Stn DW 158, 24°47′ S, 168°08′ E, 262-290 m, 13 dd. — Stn DW 159, 24°46′ S, 168°08′ E, 241-245 m, 7 dd. — Stn DW 160, 24°47′ S, 168°08′ E, 280-282 m, 2 dd. — Stn DW 163, 24°49′ S, 168°09′ E, 310-460 m, 4 dd. — Stn DW 165, 24°47′ S, 168°10′ E, 372-660 m, 1 dd. — Stn DW 170, 23°41′ S, 168°00′ E, 241-244 m, 1 dd. — Stn DW 170-172, 23°41′ S, 168°01′ E, 233-290 m, 36 dd. — Stn DW 171, 23°40′ S, 168°01′ E, 233-250 m, 1 dd. — Stn DW 173, 23°41′ S, 168°00′ E, 234-242 m, 13 dd. — Stn DW 174, 23°40′ S, 168°01′ E, 235-240 m, 6 dd. — Stn DW 175, 23°41′ S, 168°01′ E, 235-240 m, 1 lv. — Stn DW 177, 23°39′ S, 168°00′ E, 320-370 m, 2 dd. — Stn DW 181, 23°18′ S, 168°05′ E, 311-330 m, 2 dd. — Stn DW 182, 23°19′ S, 168°05′ E, 314-330 m, 2 dd. — Stn DW 184, 23°18′ S, 168°05′ E, 305-320 m, 2 dd. — Stn DW 185, 23°15′ S, 168°04′ E, 311-355 m, 1 dd.
MUSORSTOM 4: stn DW 185, 19°06′ S, 163°29′ E, 230 m, 1 lv.
BERYX 11: stn DW 11, 24°44′ S, 168°10′ E, 320-350 m, 1 dd.
BIOCAL: stn DW 64, 24°48′ S, 168°09′ E, 250 m, 2 dd. — Stn DW 65, 24°48′ S, 168°09′ E, 245-275 m, 1 spm. — Stn CP 84, 20°43′ S, 167°01′ E, 150-210 m, 1 dd.
LAGON: stn 490, 18°55′ S, 163°24′ E, 230 m, 2 spms.
CALSUB: dive 21, 22°45′ S, 167°09′ E, 340 m, 1 spm.
Loyalty Islands. MUSORSTOM 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 1 dd. — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 1 dd. — Stn DW 399, 20°42′ S, 167°00′ E, 282 m, 3 spms. — Stn DC 402, 20°30′ S, 166°49′ E, , 520 m, 1 spm. — Stn DW 407, 20°41′ S, 167°07′ E, 360 m, 1 dd. — Stn DW 417, 20°42′ S, 167°04′ E, 283 m, 1 lv. — Stn DW 418, 20°42′ S, 167°03′ E, 283 m, 1 dd. — Stn DW 422, 20°26′ S, 166°40′ E, 257 m, 1 spm. — Stn DW 423, 20°26′ S, 166°40′ E, 280 m, 3 spms. — Stn DW 457, 21°00′ S, 167°29′ E, 353 m, 1 dd. — Stn DW 482, 21°21′ S, 167°47′ E, 375 m, 2 dd. — Stn DW 485, 21°23′ S, 167°59′ E, 350 m, 1 dd.
New Hebrides Arc. VOLSMAR: stn DW 38, 22°22′ S, 168°43′ E, 380-420 m, 3 dd. — Stn DW 40, 22°20′ S, 168°42′ E, 275-295 m, 1 dd.

DISTRIBUTION. — Kermadec Islands and New Caledonia area, in 170-520 m, alive in 230-310 m.

REMARKS. — *Conus bruuni* is very similar to *C. kinoshitai* (Kuroda, 1956); however the latter species grows larger (95 vs. 60 mm), has a generally narrower last whorl (RD 0.48-0.58 vs. 0.55-0.66), a narrower protoconch (maximum diameter 1.0 vs. 1.2 mm), and a more diverse speckled colour pattern. Further studies may support the status of *Conus bruuni* as a geographical subspecies of *Conus kinoshitai*. Provisionally we consider *Conus bruuni* a valid species.

The largest specimen measures 49 × 26 mm.

Conus capitanellus Fulton, 1938

Fig. 31

Conus capitanellus Fulton, 1938: 55, pl. 3, figs 1-1a.
Conus capitanellus — COOMANS *et al.*, 1983: 82, figs 297, 334-336.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 476, 18°51′ S, 163°25′ E, 300-350 m, 1 dd. BIOCAL: stn DW 64, 24°48′ S, 168°09′ E, 250 m, 2 dd. — Stn DW 65, 24°48′ S, 168°09′ E, 245-275 m, 3 spms.

Source : MNHN, Paris

SMIB 3: stn DW 8, 24°45' S, 168°08' E, 233 m, 2 dd. — Stn DW 10, 24°42' S, 168°07' E, 235 m, 1 dd.
SMIB 4: stn DW 41, 24°44' S, 168°09' E, 230-235 m, 3 dd. — Stn DW 43, 24°47' S, 168°09' E, 235-245 m, 4 dd. — Stn DW 44, 24°46' S, 168°08' E, 270-300 m, 2 dd. — Stn DW 46, 24°47' S, 168°08' E, 245-260 m, 3 spms. — Stn DW 49, 24°45' S, 168°08' E, 240-300 m, 2 spms. — Stn DW 50, 23°42' S, 168°01' E, 260-295 m, 1 dd. — Stn DW 51, 23°41' S, 168°01' E, 245-260 m, 1 lv. — Stn DW 53, 23°40' S, 168°00' E, 250-270 m, 2 dd.
SMIB 5: stn DW 75, 23°41' S, 168°01' E, 270 m, 1 lv. — Stn DW 77, 23°41' S, 168°01' E, 270 m, 1 dd. — Stn DW 80, 23°42' S, 168°00' E, 300 m, 1 lv. — Stn DW 85, 22°20' S, 168°53' E, 260 m, 1 dd. — Stn DW 87, 22°19' S, 168°41' E, 370 m, 1 lv. — Stn DW 90, 22°19' S, 168°42' E, 340 m, 1 dd. — Stn DW 94, 22°20' S, 168°43' E, 275 m, 3 dd. — Stn DW 98, 23°02' S, 168°16' E, 335 m, 1 lv. — Stn DW 102, 23°20' S, 168°05' E, 305 m, 1 dd.
SMIB 8: stn DW 154, 24°46' S, 168°08' E, 235-252 m, 5 lv, 3 dd. — Stn DW 156, 24°46' S, 168°08' E, 275-300 m, 1 lv. — Stn DW 158, 24°47' S, 168°08' E, 262-290 m, 3 lv, 1 dd. — Stn DW 159, 24°46' S, 168°08' E, 241-245 m, 9 lv, 2 dd. — Stn DW 160, 24°47' S, 168°08' E, 280-282 m, 1 dd. — Stn CP 161, 24°47' S, 168°09' E, 232-251 m, 1 lv. — Stn DW 163, 24°50' S, 168°09' E, 310-460 m, 1 dd. — Stn DW 165, 24°47' S, 168°10' E, 372-660 m, 3 lv. — Stn DW 170-172, 23°41' S, 168°01' E, 233-290 m, 17 lv. — Stn DW 173, 23°41' S, 168°00' E, 234-242 m, 1 dd. — Stn DW 175, 23°41' S, 168°01' E, 235-240 m, 1 lv. — Stn DW 177, 23°39' S, 168°00' E, 320-370 m, 2 lv, 2 dd. — Stn DW 182, 23°19' S, 168°05' E, 314-330 m, 1 dd.
BERYX 11: stn CP 21, 24°44' S, 168°07' E, 430-450 m, 1 dd. — Stn CP 45, 23°40' S, 168°01' E, 270-290 m, 1 dd.
CHALCAL 2: stn DW 69, 24°44' S, 168°08' E, 260 m, 2 lv. — Stn DW 70, 24°46' S, 168°09' E, 232 m, 1 dd. — Stn DW 71, 24°42' S, 168°10' E, 230 m, 2 lv. — Stn DW 78, 23°41' S, 168°00' E, 233 m, 1 spm.
Loyalty Islands. MUSORSTOM 6: stn DW 391, 20°47' S, 167°06' E, 390 m, 1 lv. — Stn DW 392, 20°47' S, 167°05' E, 340 m, 1 dd. — Stn DW 397, 20°47' S, 167°05' E, 380 m, 1 dd. — Stn DW 398, 20°47' S, 167°06' E, 370 m, 4 dd. — Stn DW 399, 20°42' S, 167°00' E, 282 m, 4 spms. — Stn DW 406, 20°41' S, 167°07' E, 373 m, 1 dd. — Stn DW 416, 20°42' S, 167°00' E, 343 m, 1 dd. — Stn DW 417, 20°42' S, 167°04' E, 283 m, 2 dd. — Stn DW 418, 20°42' S, 167°03' E, 283 m, 3 dd. — Stn DW 422, 20°26' S, 166°40' E, 257 m, 2 dd. — Stn DW 423, 20°26' S, 166°40' E, 280 m, 7 dd. — Stn DW 451, 20°59' S, 167°24' E, 330 m, 2 dd. — Stn DW 452, 21°00' S, 167°25' E, 300 m, 1 dd. — Stn DW 472, 21°09' S, 167°55' E, 300 m, 1 lv. — Stn DW 478, 21°09' S, 167°54' E, 400 m, 1 dd. — Stn DW 480, 21°08' S, 167°56' E, 380 m, 5 lv. — Stn DW 482, 21°21' S, 167°47' E, 375 m, 2 dd.

DISTRIBUTION. — Japan to Philippines and around New Caledonia, in 230-430 m, alive in 230-390 m.

REMARKS. — *Conus capitanellus* is a rather common deep-water species in the northwestern Pacific.

The largest specimen measures 34 × 19 mm.

Conus cervus Lamarck, 1822

Conus cervus Lamarck, 1822: 510.
Conus cervus — MERMOD, 1947: 175. — COOMANS *et al.*, 1983: 108, figs 306, 398-399. — KOHN, 1988: 26, fig. 2.

MATERIAL EXAMINED. — **Loyalty Islands**. MUSORSTOM 6: stn CP 454, 21°01' S, 167°26' E, 260 m, 1 dd (fragment).

DISTRIBUTION. - Philippines to Indonesia, in 180-400 m; now New Caledonia in 260 m (dead).

Source : MNHN, Paris

REMARKS. — This is the first record of *C. cervus* from Melanesia. The length of the fragment is 95 mm.

Conus chiangi (Azuma, 1972)

Fig. 32

Taraniconus chiangi Azuma, 1972: 56, 59, figs 5-6.
Conus chiangi — COOMANS *et al.*, 1983: 114, figs 308, 407.

MATERIAL EXAMINED. — **New Caledonia**. SMIB 5: stn DW 95, 23°00′ S, 168°20′ E, 200 m, 1 lv.
SMIB 8: stn DW 158, 24°47′ S, 168°08′ E, 262-290 m, 2 lv.

DISTRIBUTION. — Japan to Philippines in 200-400 m; now New Caledonia, in 200-260 m (alive).

REMARKS. — This is the first record of this peculiar and rarely found deep-water species from Melanesia. The largest specimen measures 12.7 × 7.1 mm.

Conus comatosa Pilsbry, 1904

Fig. 33

Conus dormitor Pilsbry, 1904a: 6, pl. 1, figs 9-9a.
Conus comatosa Pilsbry, 1904b: 550 (*nom. nov. pro C. dormitor*).
Conus comatosa — COOMANS *et al.*, 1985a: 247, figs 439, 503-504.

MATERIAL EXAMINED. — **New Caledonia**. SMIB 8: stn DW 154, 24°46′ S, 168°08′ E, 235-252 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 392, 20°47′ S, 167°05′ E, 340 m, 3 dd. — Stn DW 399, 20°42′ S, 167°00′ E, 282 m, 1 dd. — Stn DW 417, 20°42′ S, 167°04′ E, 283 m, 1 lv. — Stn DW 418, 20°42′ S, 167°03′ E, 283 m, 3 dd. — Stn DW 453, 21°00′ S, 167°27′ E, 250 m, 1 lv.

DISTRIBUTION. — Japan, Philippines, Northwest Australia, Solomon Islands; now New Caledonia in 250-340 m, alive in 250-280 m.

REMARKS. — This is the first record of this deep-water species from the New Caledonia region. The largest specimen measures 48 × 17 mm, which is like material from Japan and Philippines.

Conus darkini Röckel, Korn & Richard, 1993

Fig. 24

Conus darkini Röckel, Korn & Richard, 1993: 48, figs 1-4.

MATERIAL EXAMINED. — **Loyalty Islands**. MUSORSTOM 6: stn CP 465, 21°04′ S, 167°32′ E, 480 m, 1 dd (paratype). — Stn CP 467, 21°05′ S, 167°32′ E, 575 m, 1 dd (holotype).

DISTRIBUTION. — Loyalty Islands in 480-575 m (dead). Philippine Sea (Kita-Koho area, E. of Ryukyu Islands) and Philippines (Balut Island).

Source : MNHN, Paris

REMARKS. — The 56 mm holotype and 49 mm paratype from the Loyalty Islands agree in all other aspects with the material from the Philippines and Philippine Sea, which measures up to 87 mm.

Conus dusaveli (H. Adams, 1872)

Leptoconus (*Phasmoconus*) *dusaveli* H. Adams, 1872: 12, pl. 3, fig. 17.
Conus dusaveli — COOMANS *et al.*, 1985b: 179, figs 224, 594, 662-664. — RICHER DE FORGES & ESTIVAL, 1986: 16.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 490, 18°55′ S, 163°24′ E, 230 m, 1 dd (fragment).
SMIB 5: stn DW 100, 23°23′ S, 168°05′ E, 120 m, 1 dd (fragment).
Loyalty Islands. MUSORSTOM 6: stn DW 440, 20°49′ S, 167°17′ E, 288 m, 1 dd (fragment).

DISTRIBUTION. — Ryukyu Islands (Japan) to Philippines and New Caledonia, in 120-290 m (dead).

REMARKS. — Length of the fragment from stn DW 100 is 57 mm.

Conus estivali Moolenbeek & Richard sp. nov.

Figs 6-7

TYPE MATERIAL. — Holotype MNHN. Paratypes: 5 MNHN, 1 ZMA 3.94.019, 1 NMNZ M268540, 1 AMS C201717, 1 DR.

TYPE LOCALITY. — Coral Sea, MUSORSTOM 5, stn DC 361, 19°53′ S, 158°38′ E, 400 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DC 361, 19°53′ S, 158°38′ E, 400 m, 1 lv (holotype), 3 dd (paratypes: ZMA, 9.5 × 5.5 mm; AMS, 9.8 × 5.7 mm; NMNZ, 9.7 × 5.5 mm). — Stn DC 362, 19°53′ S, 158°40′ E, 410 m, 1 dd (paratype DR, 9.8 × 5.7 mm). — Stn DC 378, 19°54′ S, 158°38′ E, 355 m, 3 dd (paratypes MNHN, 13 × 7.2 mm, 12 × 7 mm, 12.2 × 7.3 mm). — Stn DC 379, 19°53′ S, 158°40′ E, 370-400 m, 2 dd (paratypes MNHN, 12 × 6.8 mm, 12.5 × 7 mm).

DISTRIBUTION. — Only known from the Chesterfield Islands, Coral Sea, in 355-410 m, alive in 400 m.

DESCRIPTION. — Holotype length 10.4 mm, width 6.0 mm; shell small, thin, and shiny. Last whorl conical, RD 0.67. Sides almost straight. Shoulder sharply angulate to carinate; spire of moderate height, outline straight. *Protoconch* of about 2 whorls, maximum diameter 0.9-1.0 mm. First postnuclear whorl with 0-1 spiral groove gradually increasing to 6 grooves on top of body whorl. Just above sutures a well developed ridge, giving the spire a stepped outline. Last whorl smooth with 10-11 hardly visible striae on the anterior part. Aperture narrow, almost uniform in width. Last whorl white with some diffuse white and light brown blotches and 6 fine brown spiral lines. Protoconch milky white. Spire with brown spots along the margins of the abapical ridge.

REMARKS. — The length of paratypes ranges from 8.0 to 12.3 mm, relative diameter of last whorl from 0.63-0.69 and the relative spire height 0.09-0.16; the number of brown spiral lines on last whorl can vary from 6 to 8.

Conus estivali has no close similarities to already known species. Its shape is similar to *C. boucheti* but this species lacks the spiral sculpture on its sutural ramp and has a brown base. The colour pattern of the new species resembles *C. kanakinus* but the latter species grows larger (length up to 21 mm), has a more slender last whorl (RD $\leq$ 0.60) and a more rounded shoulder.

Source : MNHN, Paris

ETYMOLOGY. — This new species is named after Jean-Claude ESTIVAL, well known cone collector in New Caledonia, whose collection is now in MNHN.

Conus excelsus Sowerby III, 1908

Fig. 34

Conus excelsus Sowerby III, 1908: 465, text figs.
Conus excelsus — CERNOHORSKY, 1974: 133. — COOMANS *et al.*, 1986: 131. — RICHER DE FORGES & ESTIVAL, 1986: 16.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 537, 19°07′ S, 163°22′ E, 200 m, 1 dd. **Loyalty Islands**. MUSORSTOM 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 1 dd. — Stn DW 418, 20°42′ S, 167°03′ E, 283 m, 2 dd. — Stn DW 423, 20°26′ S, 166°41′ E, 280 m, 1 dd. — Stn DW 456, 21°01′ S, 167°26′ E, 240 m, 2 dd. — Stn DW 462, 21°05′ S, 167°27′ E, 200 m, 1 dd. —

DISTRIBUTION. — Japan to Philippines; Solomon Islands, New Caledonia, in 200-390 m (dead), and Queensland, Australia; Andaman Sea, off Burma.
The largest specimen measures 55 × 21 mm.

Conus gondwanensis Röckel & Moolenbeek sp. nov.

Figs 8-9, 54

TYPE MATERIAL. — Holotype MNHN. Paratypes: 2 MNHN, 1 AMS C201718, 1 NMNZ M268541, 1 ZMA 3.94.020, 1 DR.

TYPE LOCALITY. — South New Caledonia, SMIB 5, stn DW 73, 23°41′ S, 168°01′ E, 240 m.

MATERIAL EXAMINED. — **New Caledonia**. CHALCAL 2: stn CH 5, 24°44′ S, 168°09′ E, 223 m, 1 dd. — Stn DW 71, 24°42′ S, 168°10′ E, 230 m, 1 dd (paratype DR, 22.3 × 11.8 mm). — Stn DW 84, 23°24′ S, 168°07′ E, 170 m, 1 lv (paratype AMS, 19.8 × 10.5 mm).
SMIB 4: stn DW 41, 24°44′ S, 168°09′ E, 230-235 m, 1 spm (paratype MNHN, 19.8 × 10.9 mm). — Stn DW 43, 24°47′ S, 168°09′ E, 235-245 m, 1 spm (paratype MNHN, 21.7 × 11.2 mm). — Stn DW 57, 23°22′ S, 168°05′ E, 210-260 m, 1 lv.
SMIB 8: stn DW 154, 24°46′ S, 168°08′ E, 235-252 m, 1 lv, 3 dd. — Stn DW 155, 24°46′ S, 168°08′ E, 257-262 m, 1 spm. — Stn DW 158, 24°47′ S, 168°08′ E, 262-290 m, 5 spms. — Stn DW 170-172, 23°41′ S, 168°01′ E, 233-290 m, 1 dd (paratype ZMA 24.8 × 13.8 mm). — Stn DW 173, 23°41′ S, 168°00′ E, 234-242 m, 1 dd (paratype NMNZ, 28 × 14.8mm).

DISTRIBUTION. — South New Caledonia, Norfolk Ridge, in 170-260 m, alive in 170-235 m.

DESCRIPTION. — *Shell* moderately small (L 18-28 mm) and light. Spire of moderate height (RSH 0.17-0.23). Outline of spire deeply concave. *Protoconch* of more than 3 whorls, maximum diameter 0.9 mm. Postnuclear whorls (7-8) tuberculate, shoulder slightly tuberculate to carinate. Postnuclear sutural ramps with 2 increasing to 3-4 weak spiral grooves. Last whorl broadly conical (RD 0.63-0.69) to slightly pyriform, sides convex above shoulder and slightly attenuate basally. Surface of last whorl smooth; other specimens from the same locality with about 20 fine granulated spiral ribs. Ground colour white, last whorl with 2 broad light brown spiral bands, below and above centre. Holotype 21.4 × 11.6 mm.

Radula with 44 slender teeth of the vermivore type. Apical point short, with blade extending over 66%, furnished with 14 denticles.

REMARKS. — *C. granarius* Kiener, 1845 from the western Atlantic is most similar to *Conus gondwanensis*. *C. granarius* differs in its higher spire (RSH 0.22-0.33), its protoconch of less than

Source : MNHN, Paris

3 whorls and its colour pattern. Similar in shape and size are *Conus sennottorum* Rehder & Abbott, 1951 and *C. cancellatus* Hwass *in* Bruguière, 1792, both from the western Atlantic, which differ in having smooth instead of tuberculate spire whorls and shoulders.

ETYMOLOGY. — As suggested by RICHER DE FORGES (1990), the area where this species lives may represent the eastern rim of the ancient continent of Gondwanaland.

Conus howelli Iredale, 1929

Fig. 35

Conus howelli Iredale, 1929: 182, pl. 40, figs 1, 8.
Conus howelli — MARSHALL, 1981: 495, figs.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 255, 25°15′ S, 159°55′ E, 280-295 m, 1 dd.
New Caledonia. SMIB 3: stn DW 8, 24°45′ S, 168°08′ E, 233 m, 2 dd.
SMIB 5: stn DW 85, 22°20′ S, 168°43′ E, 260 m, 1 dd.
SMIB 8: stn DW 159, 24°46′ S, 168°08′ E, 241-245 m, 4 dd. — Stn DW 170-172, 23°41′ S, 168°01′ E, 233-290 m, 1 dd. — Stn DW 174, 23°40′ S, 168°01′ E, 235-240 m, 1 dd.

DISTRIBUTION. — Southern Queensland to New South Wales, North of New Zealand, and New Caledonia in 230-280 m (dead).

REMARKS. — This is the first Melanesian record of this rare species. The largest specimen (partly broken) measures 26 mm.

Conus ichinoseana (Kuroda, 1956)

Fig. 36

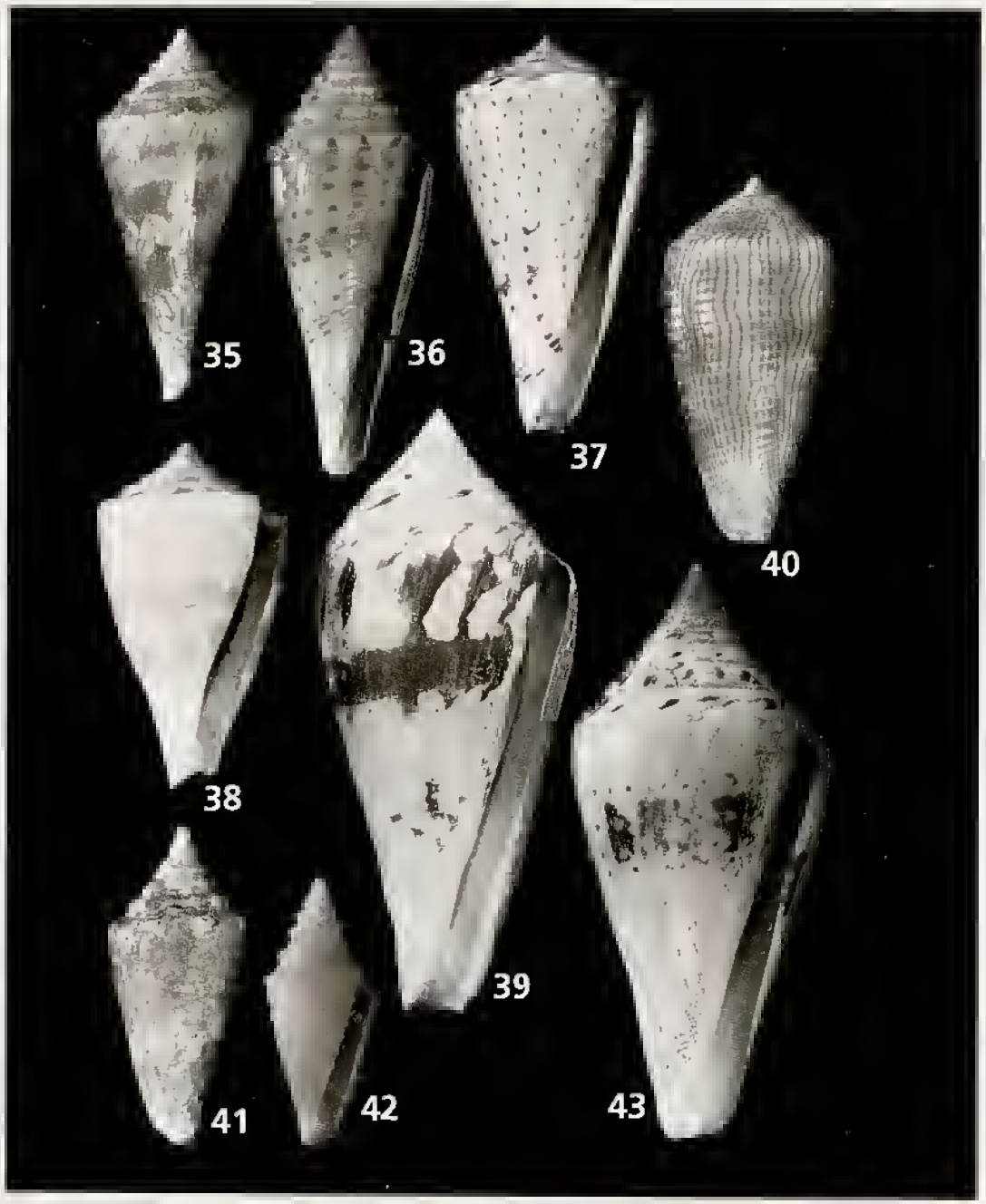
Asprella (*Conasprella* ?) *ichinoseana* Kuroda, 1956: 10, pl. 1, fig. 5.
Conus ichinoseana — RICHER DE FORGES & ESTIVAL, 1986: 16, fig. 3.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTORM 5: stn DC 361, 19°53′ S, 158°38′ E, 400 m, 1 dd. — Stn DC 372, 19°53′ S, 158°39′ E, 400 m, 1 dd.
New Caledonia. MUSORSTOM 4: stn CP 179, 18°57′ S, 163°14′ E, 475 m, 1 dd. — Stn CC 201, 18°56′ S, 163°14′ E, 490 m, 1 lv. — Stn CC 246, 22°08′ S, 167°11′ E, 410-420 m, 1 lv.
Loyalty Islands. MUSORSTOM 6: stn DW 428, 20°24′ S, 166°13′ E, 420 m, 1 lv. — Stn CP 467, 21°05′ S, 167°32′ E, 575 m, 2 dd.

DISTRIBUTION. — Japan to Philippines; Northwest Australia and New Caledonia, in 400-575 m, alive in 420-490 m.

REMARKS. — Largest specimen measures 46 × 18 mm. Specimens from Taiwan may reach 105 mm in length.

Source : MNHN, Paris



FIGS 35-43. — **35**, *Conus howelli*, New Caledonia, Norfolk Ridge, SMIB 8: stn DW 174, 23.7 × 9.5 mm. — **36**, *Conus ichinoseana*, New Caledonia, MUSORSTOM 4: stn CC 246, 46.5 × 17.4 mm. — **37**, *Conus ione*, New Caledonia, MUSORSTOM 4: stn DW 210, 46.3 × 24.2 mm. — **38**, *Conus pagodus*, New Caledonia, "*Vauban*" 1978-79: stn 9, 27.0 × 15.3 mm. — **39**, *Conus pergrandis*, Loyalty Islands, MUSORSTOM 6: stn DW 391, 116.8 × 50.8 mm. — **40**, *Conus kuroharai*, Loyalty Islands, MUSORSTOM 6: stn DW 422, 41.4 × 20.1 mm. — **41**, *Conus polongimarumai*, New Caledonia, LAGON: stn 476, 23 × 10 mm. — **42**, *Conus raoulensis*, Coral Sea, MUSORSTOM 5: stn 255, 15.0 × 6.2 mm. — **43**. — *Conus stupa*, Loyalty Islands, MUSORSTOM 6: stn CP 464, 77.5 × 25.1 mm.

Source : MNHN, Paris

Conus ione Fulton, 1938

Fig. 37

Conus ione Fulton, 1938: 55, pl. 3, fig. 2.
Conus ione — Richer de Forges & Estival, 1986: 16, fig.

Material examined. — **New Caledonia**. BIOCAL: stn DW 38, 23°00′ S, 167°15′ E, 360 m, 1 dd. MUSORSTOM 4: stn DW 181, 18°57′ S, 163°22′ E, 350 m, 1 lv. — Stn DW 210, 22°44′ S, 167°09′ E, 340-345 m, 1 dd. — Stn DW 223, 22°57′ S, 167°30′ E, 545-560 m, 1 spm. — Stn DW 226, 22°47′ S, 167°22′ E, 390 m, 1 dd. — Stn DW 230, 22°52′ S, 167°12′ E, 390-420 m, 2 lv.
SMIB 3: stn DW 17, 23°41′ S, 167°59′ E, 238 m, 1 dd.
SMIB 8: stn DW 181, 23°18′ S, 168°05′ E, 311-330 m, 1 lv. — Stn DW 182, 23°19′ S, 168°05′ E, 314-330 m, 1 lv. — Stn DW 184, 23°18′ S, 168°05′ E, 305-320 m, 1 lv. — Stn DW 185, 23°15′ S, 168°04′ E, 311-355 m, 2 lv. — Stn DW 187, 23°17′ S, 168°06′ E, 390-540 m, 1 lv. — Stn DW 189, 23°18′ S, 168°06′ E, 400-402 m, 2 lv.
BERYX 11: stn CH 54, 23°45′ S, 168°17′ E, 390-420 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 398, 20°47′ S, 167°06′ E, 370 m, 1 dd. — Stn DW 406, 20°41′ S, 167°07′ E, 373 m, 3 dd. — Stn DW 457, 21°00′ S, 167°29′ E, 353 m, 1 dd. — Stn DW 487, 21°23′ S, 167°46′ E, 500 m, 1 dd.

Distribution. — Japan to Philippines; New Caledonia, in 240-560 m, alive in 320-400 m; off Northwest Australia, and Mozambique.

Remarks. — Largest specimen 46 × 24 mm. Shells from Japan can reach 76 mm in length.

Conus kanakinus Richard, 1983

Fig. 19

Conus kanakinus Richard, 1983: 55, 58, figs 5-9.

Material examined. — **New Caledonia**. *"Vauban"* 1978-79: 22°49′ S, 167°12′ E, 390-395 m (holotype and 2 paratypes). — 22°46′ S, 167°12′ E, 390-400 m (2 paratypes).
LAGON: stn 444, 18°15′ S, 162°59′ E, 300-350 m, 4 lv. — Stn 475, 18°36′ S, 163°11′ E, 415-460 m, 3 dd, 1 spm. — Stn 1152, 18°58′ S, 163°24′ E, 335 m, 5 spms. — Stn 1153, 18°58′ S, 163°23′ E, 330 m, 1 dd.
BIOCAL: stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 3 lv, 23 dd.
MUSORSTOM 4: stn DW 156, 18°54′ S, 163°19′ E, 525 m, 1 dd. — Stn DW 159, 18°46′ S, 163°16′ E, 585-600 m, 3 dd. — Stn DW 162, 18°35′ S, 163°10′ E, 525 m, 4 dd. — Stn DW 181, 18°57′ S, 163°22′ E, 350 m, 1 lv. — Stn DW 183, 19°02′ S, 163°26′ E, 280 m, 1 lv, 3 dd. — Stn DW 184, 19°04′ S, 163°27′ E, 260 m, 1 lv, 4 dd. — Stn DW 196, 18°55′ S, 163°24′ E, 450 m, 7 dd. — Stn DW 197, 18°51′ S, 163°21′ E, 550 m, 13 dd. — Stn DW 212, 22°47′ S, 167°10′ E, 375-380 m, 2 dd. — Stn DW 221, 22°59′ S, 167°37′ E, 535-560 m, 1 dd. — Stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 3 lv. — Stn DW 223, 22°57′ S, 167°30′ E, 545-560 m, 1 dd. — Stn DW 224, 22°55′ S, 167°27′ E, 575-595 m, 1 dd. — Stn DW 230, 22°52′ S, 167°12′ E, 390-420 m, 1 dd.
SMIB 1: stn DW 2, 22°52′ S, 167°13′ E, 415 m, 1 lv, 5 dd.
SMIB 2: stn DW 3, 22°56′ S, 167°15′ E, 412-428 m, 6 dd. — Stn DW 4, 22°53′ S, 167°13′ E, 410-417 m, 4 dd. — Stn DW 5, 22°56′ S, 167°14′ E, 398-410 m, 1 lv, 8 dd. — Stn DW 6, 22°57′ S, 167°16′ E, 442-460 m, 1 dd. — Stn DW 8, 22°54′ S, 167°12′ E, 435-447 m, 1 dd. — Stn DW 10, 22°55′ S, 167°16′ E, 490-495 m, 1 dd. — Stn DW 12, 22°53′ S, 167°14′ E, 445-460 m, 1 lv. — Stn DW 14, 22°53′ S, 167°13′ E, 405-444 m, 2 dd. — Stn DW 16, 22°51′ S, 167°12′ E, 390 m, 2 dd.

Source : MNHN, Paris

SMIB 3: stn DW 21, 22°59′ S, 167°19′ E, 525 m, 1 dd. — Stn DW 29, 22°47′ S, 167°12′ E, 405 m, 8 dd. — Stn CP 4, 24°54′ S, 168°21′ E, 530 m, 2 dd.
SMIB 4: stn DW 66, 22°56′ S, 167°15′ E, 400-430 m, 2 lv.

DISTRIBUTION. — New Caledonia in 260-585 m, alive in 260-445 m.

REMARKS. — The largest specimen measures 20 mm in length.

Conus kinioi (Habe, 1965)

Rhizoconus kinioi Habe, 1965: 47-48, pl. 4, figs 1-2.
Conus kimioi — RICHER DE FORGES & ESTIVAL, 1986: 16.

MATERIAL EXAMINED. — **Chesterfield Islands**. CHALCAL 1: stn DC 38, 20°00′ S, 158°46′ E, 250 m, 1 dd.
New Caledonia. LAGON: stn 490, 18°55′ S, 163°24′ E, 230 m, 1 dd.
MUSORSTOM 4: stn DW 205, 22°38′ S, 167°07′ E, 140-160 m, 1 dd.

DISTRIBUTION. — Japan to Philippines, New Caledonia in 160-250 m (dead).

REMARKS. — The largest specimen from Lagon Nord (New Caledonia) measures 16 × 7 mm whereas specimens from Philippines can reach a length up to 23 mm.

Conus kuroharai (Habe, 1965)

Fig. 40

Asprella kuroharai Habe, 1965: 46, pl. 4, figs 3-4.

MATERIAL EXAMINED. — **Loyalty Islands**. MUSORSTOM 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 2 dd. — Stn DW 399, 20°42′ S, 167°00′ E, 282 m, 1 dd. — Stn DW 422, 20°26′ S, 166°40′ E, 257 m, 1 dd. — Stn DW 452, 21°00′ S, 167°25′ E, 300 m, 2 dd.
New Hebrides Arc. VOLSMAR: stn DW 40, 22°20′ S, 168°41′ E, 275-295 m, 1 dd.

DISTRIBUTION. — A deep-water species so far known only from Japan to Philippines; now New Caledonia, in 257-390 m (dead).

REMARKS. — This is the first record of this species from Melanesia. The largest specimen measures 51.3 mm in length.

Conus lani Crandall, 1979

Fig. 23

Conus lani Crandall, 1979: 113, figs 1-2.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 223, 22°57′ S, 167°30′ E, 545-560 m, 1 dd.
Loyalty Islands. BIOGEOCAL: stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 1 dd.

DISTRIBUTION. — Taiwan, Philippines, Solomon Islands, now New Caledonia in 315-545 m (dead).

Source : MNHN, Paris

REMARKS. — This is the first record of this rarely found species from the New Caledonian region. The largest specimen measures 54 mm in length.

Conus loyaltiensis Röckel & Moolenbeek sp. nov.

Figs 1, 10-11, 55

TYPE MATERIAL. — Holotype MNHN. Paratypes: 4 MNHN, 1 ZMA 3.94.025, 1 NMNZ M268542, 1 AMS C201719, 1 DR.

TYPE LOCALITY. — Loyalty Ridge, MUSORSTOM 6, stn CP 465, 21°04′ S, 167°32′ E, 480 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DC 357, 19°37′ S, 158°46′ E, 630 m, 1 dd. — Stn DC 380, 19°38′ S, 158°44′ E, 555-570 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn CP 465, 21°04′ S, 167°32′ E, 480 m, 1 lv (holotype), 4 dd (paratypes: ZMA, 23.1 × 11.1 mm; NMNZ, 24.5 × 11.1 mm; AMS, 21.2 × 10 mm; DR, 22.5 × 10.7 mm). — Stn CP 467, 21°05′ S, 167°32′ E, 575 m, 3 dd (paratypes MNHN, 21.0 × 9.6 mm; 22.4 × 10.3 mm; 20.6 × 9.8 mm), 1 spm (paratype MNHN, 21.6 × 10.2 mm).

DISTRIBUTION. — Known with certainty only from the Loyalty Islands in 480 (live) — 575 m. The two specimens from the Chesterfield Islands, in 570-630 m, are dead collected, possibly subfossil, and are tentatively identified as *C. loyaltiensis*.

DESCRIPTION. — Holotype: shell small, light, and biconic (shell length 21.8 mm, width 10.1 mm, aperture height 16.6 mm, RD 0.61). *Protoconch* of 1.75 glossy whorls, maximum diameter 1.0 mm. Spire of moderate height (RSH 0.24), consisting of 7.25 postnuclear whorls; outline deeply concave. Postnuclear whorls nodulose and slightly stepped; first whorls with 12 nodules. Postnuclear sutural ramps concave; gradually a subsutural groove is formed, which is already well represented on the 2nd ramp, increasing to 4 strong and deeply incised spiral grooves with axial opisthocline riblets in later ramps. Nodules which are prominent on 2-6 whorls gradually diminish toward shoulder. Shoulder weakly tuberculate and carinate, with a ridge just below it. Sides of last whorl slightly sigmoid, attenuated near base. Basal half of last whorl with about 20 distinct spiral ribbons with flat surface, separated by axially striate grooves. Upper part smooth, with only microscopic spiral striae and hardly visible axial growth lines. Aperture straight, outer lip thin. Colour uniformly milky white. Periostracum greyish brown, thin, translucent, and smooth.

Radula with relatively large teeth (0.6 mm for a 22.4 mm shell). Apical part very short, base oblique.

REMARKS. — Shell length of paratypes 21.5-26 mm, RD 0.61-0.63, RSH 0.22-0.24; number of postnuclear whorls 7.25-8, number of spiral grooves on late sutural ramps 3-4. Shape, sculpture, and colour otherwise homogeneous. The two specimens from Chesterfield Islands differ slightly from those from the Loyalty Islands by having a lower spire and less pronounced nodules.

Conus loyaltiensis is similar to *C. vaubani* in size and colour, and also in its paucispiral protoconch, but differs in having slightly stepped spire whorls, 4 strong spiral grooves instead of 8-9 weak spiral grooves or striae on late spire whorls, deeply concave instead of rather sigmoid spire outline, last whorl with ribbons on basal half or third instead of fine ribs basally changing to spiral striae up to shoulder. Axial costae below shoulder and brown streaks are absent. *Conus teramachii*, *C. ione*, *C. smirna*, and *C. profundorum* differ from the new species in having multispiral protoconchs.

Conus luciae Moolenbeek, 1986

Fig. 16

Conus luciae Moolenbeek, 1986: 211, figs 1-3.

MATERIAL EXAMINED. — **Chesterfield Islands**. CHALCAL 1: stn DC 66, 22°27′ S, 159°20′ E, 320 m (paratype). — Stn DC 68, 22°35′ S, 159°16′ E, 296 m (holotype).

Source : MNHN, Paris

MUSORSTOM 5: stn DW 255, 25°15′ S, 159°55′ E, 280-295 m, 3 dd. — Stn DW 256, 25°18′ S, 159°53′ E, 290-300 m, 1 dd. — Stn DW 261, 300 m, 2 spms. — Stn DW 270, 24°49′ S, 159°34′ E, 223 m, 1 dd. — Stn DW 274, 24°45′ S, 159°41′ E, 285 m, 1 dd. — Stn CP 275, 24°47′ S, 159°40′ E, 285 m, 1 lv. — Stn DW 277, 24°11′ S, 159°35′ E, 270 m, 1 spm. — Stn DW 281, 24°11′ S, 159°34′ E, 272 m, 1 dd. — Stn CP 287, 24°05′ S, 159°36′ E, 270 m, 1 spm. — Stn DW 299, 22°48′ S, 159°24′ E, 360-390 m, 1 dd. — Stn DW 300, 22°48′ S, 159°24′ E, 450 m, 1 dd. — Stn DW 301, 22°07′ S, 159°25′ E, 487-610 m, 1 lv. — Stn DW 303, 22°12′ S, 159°23′ E, 332 m, 1 dd. — Stn DW 304, 22°10′ S, 159°26′ E, 385-420 m, 1 dd. — Stn DW 306, 22°08′ S, 159°21′ E, 375-415 m, 1 dd. — Stn CP 311, 22°14′ S, 159°24′ E, 320 m, 1 lv. — Stn CP 315, 22°25′ S, 159°27′ E, 330-335 m, 1 lv.

New Caledonia. SMIB 3: stn DW 8, 24°45′ S, 168°08′ E, 233 m, 1 dd. — Stn DW 18, 23°42′ S, 167°59′ E, 338 m, 1 dd. — Stn DW 20, 23°40′ S, 168°00′ E, 280 m, 2 dd.

SMIB 4: stn DW 38, 24°55′ S, 168°22′ E, 510 m, 2 dd. — Stn DW 44, 24°46′ S, 168°08′ E, 270-300 m, 1 lv. — Stn DW 46, 24°47′ S, 168°08′ E, 245-260 m, 2 lv. — Stn DW 48, 24°46′ S, 168°09′ E, 240-245 m, 1 dd. — Stn DW 52, 23°41′ S, 168°00′ E, 235-250 m, 1 lv. — Stn DW 56, 23°21′ S, 168°05′ E, 230-260 m, 1 lv.

SMIB 5: stn DW 74, 23°40′ S, 168°01′ E, 245 m, 1 dd. — Stn DW 76, 23°41′ S, 168°00′ E, 280 m, 1 dd. — Stn DW 98, 23°02′ S, 168°16′ E, 335 m, 1 spm.

SMIB 8: stn DW 160, 24°47′ S, 168°08′ E, 280-282 m, 1 dd. — Stn DW 170-172, 23°41′ S, 168°01′ E, 233-290 m, 1 dd. — Stn DW 182, 23°19′ S, 168°05′ E, 314-330 m, 1 lv. — Stn DW 187, 23°17′ S, 168°06′ E, 390-540 m, 1 lv. — Stn DW 189, 23°18′ S, 168°06′ E, 400-402 m, 1 lv.

CHALCAL 2: stn DW 69, 24°44′ S, 168°08′ E, 260 m, 2 spms. — Stn DW 70, 24°46′ S, 168°09′ E, 232 m, 1 dd.

Loyalty Islands. MUSORSTOM 6: stn DW 418, 20°42′ S, 167°03′ E, 283 m, 1 dd. — Stn DW 457, 21°00′ S, 167°29′ E, 353 m, 1 dd.

BIOGEOCAL: stn KG 252, 21°31′ S, 166°21′ E, 330 m, 2 dd.

DISTRIBUTION. — Previously known only from two empty shells from the Coral Sea, *Conus luciae* is now shown to be a regionally widespread species, from the Coral Sea to the Loyalty Is, in 225-510 m, alive in 245-485 m.

REMARKS. — The larval shell of *Conus luciae* has about 3 whorls, maximum diameter is 0.9 mm, indicating a planktotrophic larval development.

Conus orbignyi coriolisi Moolenbeek & Richard ssp. nov.

Figs 12-13

Conus orbignyi – RICHER DE FORGES & ESTIVAL, 1986: 16, fig.

TYPE MATERIAL. — Holotype MNHN. Paratypes: 1 ZMA 3.94.021, 1 AMS C201720, 1 NMNZ M268543, 1 DR, 1 MNHN.

TYPE LOCALITY. — Coral Sea, Lord Howe Rise, Capel Bank, MUSORSTOM 5, stn DW 266, 25°29′ S, 159°46′ E, 240 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. CHALCAL 1: stn DC 64, 22°11′ S, 159°15′ E, 305 m, 1 spm.

MUSORSTOM 5: stn 258, 25°33′ S, 159°46′ E, 300 m, 4 dd. — Stn DW 260, 25°29′ S, 159°44′ E, 285 m, 1 dd. — Stn DW 261, 25°27′ S, 159°46′ E, 300 m, 1 lv. — Stn DW 263, 25°21′ S, 159°46′ E, 225-150 m, 1 lv. — Stn DW 265, 25°21′ S, 159°45′ E, 190-260 m, 2 dd. — Stn DW 266, 25°29′ S, 159°46′ E, 240 m, 1 lv (holotype), 5 spms (paratypes: 43.2 × 15.6 mm, ZMA; 42.8 × 15.6 mm, AMS; 36.3 × 13.7 mm, NMNZ; 38.7 × 14.9 mm, DR; 41.7 × 16.5 mm, MNHN). — Stn 268, 24°45′ S,

Source : MNHN, Paris

159°39′ E, 280 m, 1 dd. — Stn DW 274, 24°45′ S, 159°41′ E, 285 m, 1 dd. — Stn DW 284, 24°10′ S, 159°33′ E, 225-230 m, 2 dd. — Stn DW 285, 24°09′ S, 159°34′ E, 245-255 m, 2 dd. — Stn 290, 23°06′ S, 159°26′ E, 300 m, 1 dd. — Stn DW 294, 23°11′ S, 159°30′ E, 272 m, 1 dd. — Stn 302, 22°10′ S, 159°23′ E, 345-360 m, 1 dd. — Stn 303, 22°12′ S, 159°23′ E, 332 m, 2 dd. — Stn 306, 22°08′ S, 159°21′ E, 375-415 m, 1 dd juv. — Stn CP 318, 22°27′ S, 159°21′ E, 330 m, 1 dd.

New Caledonia. LAGON: stn 539, 19°05′ S, 163°17′ E, 240 m, 2 dd.

MUSORSTOM 4: stn CP 172, 19°01′ S, 163°16′ E, 275-330 m, 1 dd. — Stn DW 220, 22°58′ S, 167°38′ E, 505-550 m, 1 dd juv.

SMIB 6: stn DW 130, 19°05′ S, 163°21′ E, 225-230 m, 1 dd. — Stn DW 132, 19°03′ S, 163°19′ E, 235-240 m, 1 dd. — Stn DW 136, 19°01′ S, 163°18′ E, 300-320 m, 2 dd.

BERYX 11: stn DW 11, 24°44′ S, 168°10′ E, 320-350 m, 1 dd.

Loyalty Islands. MUSORSTOM 6: stn DW 395, 20°48′ S, 167°05′ E, 400 m, 1 dd. — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 2 dd. — Stn DW 452, 21°00′ S, 167°25′ E, 300 m, 1 dd. — Stn DW 481, 21°22′ S, 167°50′ E, 300 m, 1 dd.

DISTRIBUTION. — Coral Sea, New Caledonia and Loyalty Ridge, alive in 225-330 m.

DESCRIPTION. — Holotype length 44.6 mm, width 15.0 mm; shell thin. Last whorl narrowly conical, RD 0.46, outline slightly convex below shoulder tapering toward the base. Spire high (Relative spire height 0.27), outline concave. Protoconch of 3 or more smooth and glossy whorls. Teleoconch of 9 1/2, tuberculate whorls. Teleoconch sutural ramps slightly concave with 1 increasing to 5-7 spiral grooves, crossed by axial threads. Last whorl with spiral grooves containing axial riblets; grooves becoming obsolete in adapical third. Aperture narrow, outer lip thin. Colour of protoconch transparent white, spire white with a few irregular brown blotches. Last whorl with 3 spiral bands or irregular brown blotches. Aperture white.

REMARKS. — Shells of paratypes and other specimens are very homogeneous in sculpture and pattern. Length of adult specimens 35-53 mm, relative diameter of last whorl 0.45-0.55, relative spire height 0.24-0.30.

Conus orbignyi coriolisi ssp. nov. differs from the nominal subspecies *Conus o. orbignyi* Audouin, 1831 (NW Pacific) and from *Conus orbignyi elokismenos* Kilburn, 1975 (West Indian Ocean; see KILBURN, 1973) in its smaller size (53 mm vs. 87 mm and 65 mm respectively), last whorl almost smooth adapically, and its colour pattern usually reduced to 3 interrupted brown spiral bands.

ETYMOLOGY. — This new subspecies is named after R.V. "*Coriolis*" aboard which the MUSORSTOM 5 expedition was carried.

Conus pagodus Kiener, 1845

Fig. 38

Conus pagodus Kiener, 1845: pl. 70, fig. 4; 1849-1850: 310.
Conus pagodus – KOHN, 1968: 445, pl. 3, fig. 22. — COOMANS *et al.*, 1983: 77-78, figs 295, 329, 332-333. — VINK & RÖCKEL, 1984: 5.
Conus cancellatus – RICHER DE FORGES & ESTIVAL, 1986: 16.

MATERIAL EXAMINED. — **New Caledonia.** *"Vauban"* 1978-79: stn 9, 22°20′ S, 167°10′ E, 175-200 m, 2 dd. — Stn 30, 22°39′ S, 167°07′ E, 170-190 m, 1 spm.

LAGON: stn 372b, 22°41′ S, 167°03′ E, 215 m, 1 dd.

BIOCAL: stn CP 105, 21°31′ S, 166°22′ E, 330-335 m, 1 dd. — Stn CP 108, 22°03′ S, 167°06′ E, 335 m, 1 lv.

Loyalty Islands. MUSORSTOM 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 1 dd, 1 lv. — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 1 dd. — Stn DW 442, 20°54′ S, 167°17′ E, 200 m, 1 lv.

DISTRIBUTION. — Japan to Philippines; New Caledonia in 190-390 m, alive in 200-390 m; southern Red Sea.

Source : MNHN, Paris

REMARKS. — The nomenclature of this species is a matter of discussion. COOMANS *et al.* (1983) preferred to retain the name *Conus cancellatus* Hwass *in* Bruguière, 1792. However, the holotype of *C. cancellatus*, selected by KOHN (1968), represents the western Atlantic species *C. austini* Rehder & Abbott, 1951. COOMANS *et al.* suspect for several reasons that the (original) holotype of *Conus cancellatus* is lost and replaced by a specimen of *C. austini*. The problem cannot be unequivocally solved at present, and a decision of the ICZN will be necessary. Hence, we prefer to use the first available name *Conus pagodus* Kiener, 1845.

Conus pergrandis (Iredale, 1937)

Fig. 39

Embrikena pergrandis Iredale, 1937: 407, pl. 18.

MATERIAL EXAMINED. — **New Caledonia**. SMIB 5: stn DW 87, 22°19′ S, 168°41′ E, 370 m, 1 dd. — Stn DW 92, 22°20′ S, 168°41′ E, 280 m, 1 dd.
Loyalty Islands. CALSUB: dive 16, 20°38′ S, 167°03′ E, 509 m, 1 lv.
MUSORSTOM 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 1 lv. — Stn DW 392, 20°47′ S, 167°05′ E, 340 m, 1 dd. — Stn DW 418, 20°42′ S, 167°03′ E, 283 m, 1 lv.
New Hebrides Arc. VOLSMAR: stn DW 7, 22°26′ S, 171°44′ E, 325-400 m, 1 dd.

DISTRIBUTION. — Taiwan, Philippines, Papua New Guinea, and Queensland; now New Caledonia in 283-509 m (alive).

REMARKS. — This is the first record of this species from the New Caledonia region. The largest specimen measures 117 mm in length.

Conus plinthis Richard & Moolenbeek, 1988

Fig. 20

Conus plinthis Richard & Moolenbeek, 1988: 235, pl. 1, figs 6-9, 11.
Conus sp. B — RICHER DE FORGES & ESTIVAL, 1986: 15, figs.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 7, 22°19′ S, 167°11′ E, 300-315 m, 2 dd.
BIOCAL: stn DW 64, 24°48′ S, 168°09′ E, 250 m (paratype AMS). — Stn DW 65, 24°48′ S, 168°09′ E, 245-275 m (paratype MNHN).
MUSORSTOM 4: stn DW 164, 18°33′ S, 163°13′ E, 225 m (paratype ZMA 388018). — Stn DW 210, 22°44′ S, 167°09′ E, 340-345 m (holotype MNHN). — Stn DW 222, 22°58′ S, 167°33′ E, 410-440 m, 1 dd. — Stn DW 234, 22°15′ S, 167°08′ E, 350-365 m (paratype NMNZ).
CHALCAL 2: stn DW 69, 24°44′ S, 168°08′ E, 260 m, 2 dd. — Stn DW 70, 24°46′ S, 168°09′ E, 232 m (paratype NMNZ). — Stn DW 78, 23°41′ S, 168°00′ E, 233 m, 1 lv. — Stn DW 79, 23°41′ S, 168°00′ E, 243 m, 1 dd.
SMIB 3: stn DW 9, 24°42′ S, 168°08′ E, 265 m (paratype MNHN). — Stn DW 10, 24°42′ S, 168°07′ E, 235 m, 2 dd. — Stn DW 14, 23°40′ S, 168°00′ E, 246 m, 3 lv. — Stn DW 17, 23°41′ S, 167°59′ E, 238 m, 1 dd. — Stn DW 18, 23°42′ S, 167°59′ E, 338 m, 4 dd. — Stn DW 20, 23°40′ S, 168°00′ E, 280 m, 15 dd.
SMIB 4: stn DW 40, 24°46′ S, 168°09′ E, 240-260 m, 1 dd. — Stn DW 41, 24°44′ S, 168°09′ E, 230-235 m, 1 dd. — Stn DW 43, 24°47′ S, 168°09′ E, 235-245 m, 2 spms. — Stn DW 44, 24°46′ S, 168°08′ E, 270-300 m, 1 dd. — Stn DW 45, 24°46′ S, 168°09′ E, 245-260 m, 2 dd. — Stn DW 46, 24°47′ S, 168°08′ E, 245-260 m, 1 spm. — Stn DW 47, 24°46′ S, 168°08′ E, 250-280 m, 1 spm. — Stn

Source : MNHN, Paris

DW 49, 24°45′ S, 168°08′ E, 240-300 m, 1 dd. — Stn DW 50, 23°42′ S, 168°01′ E, 260-295 m, 1 dd. — Stn DW 51, 23°41′ S, 168°01′ E, 245-260 m, 4 dd. — Stn DW 52, 23°41′ S, 168°00′ E, 235-250 m, 2 dd. — Stn DW 53, 23°40′ S, 168°00′ E, 250-270 m. 12 lv. — Stn DW 54, 23°40′ S, 168°00′ E. 230-235 m. 1 spm. — Stn DW 55, 23°21′ S, 168°04′ E, 215-260 m, 2 dd. — Stn DW 56, 23°21′ S, 168°05′ E, 230-260 m, 1 lv. — Stn DW 57, 23°21′ S, 168°05′ E, 216-260 m, 1 dd.
SMIB 5: stn DW 70, 23°41′ S, 168°01′ E, 270 m. 5 dd. — Stn DW 71, 23°41′ S, 168°01′ E, 265 m, 2 dd. — Stn DW 72, 23°42′ S, 168°01′ E, 400 m, 3 dd. — Stn DW 73, 23°41′ S. 168°01′ E, 240 m, 2 dd. — Stn DW 75, 23°41′ S, 168°01′ E, 270 m, 4 dd. — Stn DW 79. 23°41′ S, 168°01′ E, 285 m, 2 dd. — Stn DW 85, 22°20′ S, 168°53′ E. 260 m, 1 dd. — Stn DW 87, 22°19′ S, 168°41′ E, 370 m. 1 dd. — Stn DW 90, 22°19′ S, 168°42′ E, 340 m, 1 dd. — Stn DW 92, 22°20′ S, 168°41′ E, 280 m, 1 dd. — Stn DW 93. 22°20′ S, 168°42′ E, 255 m, 1 lv. — Stn DW 94, 22°20′ S, 168°43′ E, 275 m, 4 dd. — Stn DW 98, 23°02′ S, 168°16′ E, 335 m, 3 spms. — Stn DW 101, 23°21′ S, 168°05′ E, 270 m, 1 dd. — Stn DW 102, 23°20′ S. 168°05′ E. 305 m, 2 lv, 1 dd. — Stn DW 104, 23°16′ S, 168°04′ E, 335 m, 1 dd.
SMIB 8: stn DW 154. 24°46′ S, 168°08′ E, 235-252 m, 1 lv. - - Stn DW 158, 24°47′ S, 168°08′ E, 262-290 m, 4 dd. — Stn DW 159, 24°46′ S, 168°08′ E, 241-245 m, 2 dd. — Stn DW 160, 24°47′ S, 168°08′ E, 280-282 m, 2 dd. — Stn CP 161. 24°47′ S, 168°09′ E, 232-251 m, 1 dd. — Stn CP 162, 24°48′ S, 168°09′ E, 254-264 m, 1 dd. — Stn DW 163, 24°50′ S, 168°09′ E, 310-460 m, 4 spms. — Stn DW 170-172, 23°41′ S, 168°01′ E, 233-290 m, 20 dd, 4 spms. — Stn DW 171, 23°40′ S. 168°01′ E, 233-250 m, 1 lv. — Stn DW 173, 23°41′ S, 168°00′ E, 234-242 m, 2 spms. — Stn DW 174, 23°40′ S, 168°01′ E, 235-240 m, 7 spms. — Stn DW 176, 23°42′ S, 168°01′ E, 283-290 m, 1 lv. — Stn DW 177, 23°39′ S, 168°00′ E. 320-370 m, 1 dd. — Stn DW 181, 23°18′ S, 168°05′ E, 311-330 m. 2 lv, 2 dd. — Stn DW 182, 23°19′ S, 168°05′ E, 314-330 m, 2 lv, 5 dd. — Stn DW 183, 23°18′ S, 168°05′ E, 330-367 m. 4 lv. - - Stn DW 184, 23°18′ S. 168°05′ E, 305-320 m, 6 dd. — Stn DW 185, 23°15′ S, 168°04′ E, 311-355 m, 3 lv, 1 dd. — Stn DW 187, 23°17′ S, 168°06′ E, 390-540 m, 2 lv. — Stn DW 189, 23°18′ S, 168°06′ E, 400-402 m, 3 dd.
BERYX 11: stn DW 11, 24°44′ S, 168°10′ E. 320-350 m, 2 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 391, 20°47′ S, 167°06′ E, 390 m, 1 dd. — Stn DW 399, 20°42′ S, 167°00′ E, 282 m, 2 dd. — Stn CP 400, 20°42′ S. 167°00′ E, 270 m, 1 lv. — Stn DW 482, 21°21′ S, 167°47′ E, 375 m, 1 lv.
New Hebrides Arc. VOLSMAR: stn DW 7, 22°26′ S, 171°44′ E, 325-400 m, 3 dd.

DISTRIBUTION. — New Caledonia, in 230-410 m, alive in 233-390 m; Norfolk Island, Kermadec Islands, dead in 135-259 m.

REMARKS. — Largest specimen (holotype) 43.9 × 24.0 mm; mean length of live taken specimens about 20 mm.

Conus polongimarumai Kosuge, 1980

Fig. 41

Conus polongimarumai Kosuge, 1980: 63, pl. 18, figs 6-8.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 476, 18°51′ S, 163°26′ E, 300-350 m, 1 dd.

DISTRIBUTION. — West Thailand, Philippines and Marshall Islands (JOHNSON, 1992: 10); now New Caledonia. dead in ca. 300 m.

REMARKS. — This rare species, once only known from the Philippines, was recently found in Thailand and the Marshall Islands. The only specimen from New Caledonia is a dead collected

Source : MNHN, Paris

specimen with an encrusted apex. Nevertheless its size (23 × 9.5 mm), shape, sculpture and pattern suggest conspecificity with *Conus polongimarumai*. It is the first record of this species from Melanesia.

Conus profundorum (Kuroda, 1956)

Fig. 22

Chelyconus (?) (*Profundiconus*) *profundorum* Kuroda, 1956: 4, textfigs 8-9.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 3 spms.
MUSORSTOM 4: stn DW 234, 20°15′ S, 167°08′ E, 350-365 m, 1 dd. — Stn DW 235, 22°13′ S, 167°12′ E, 405-415 m, 1 dd.
CHALCAL 2: stn DW 76, 23°40′ S, 167°45′ E, 470 m, 1 dd. — Stn DW 77, 23°38′ S, 167°43′ E, 435 m, 1 dd. — Stn DW 82, 23°14′ S, 168°04′ E, 304 m, 1 lv, 1 dd. — Stn CC 1, 24°55′ S, 168°22′ E, 500 m, 1 lv.
SMIB 3: stn DW 1, 24°56′ S, 168°22′ E, 520 m, 2 dd. — Stn DW 3, 24°55′ S, 168°22′ E, 513 m, 1 dd. — Stn DW 5, 24°55′ S, 168°22′ E, 502-512 m, 3 dd. — Stn DW 9, 24°42′ S, 168°08′ E, 265 m, 2 dd. — Stn DW 22, 23°03′ S, 167°19′ E, 503 m, 2 dd.
SMIB 4: stn DW 34, 24°55′ S, 168°22′ E, 510-515 m, 2 dd. — Stn DW 36, 24°56′ S, 168°22′ E, 500-530 m, 1 dd. — Stn DW 37, 24°55′ S, 168°22′ E, 515-540 m, 3 spms.
SMIB 8: stn DW 146, 24°55′ S, 168°22′ E, 514-522 m, 4 dd. — Stn DW 148, 24°56′ S, 168°21′ E, 510 m, 1 dd. — Stn DW 149, 24°55′ S, 168°22′ E, 508-510 m, 3 dd. — Stn DW 150, 24°54′ S, 168°22′ E, 519-530 m, 2 dd. — Stn DW 167, 23°38′ S, 167°43′ E, 430-452 m, 1 dd. — Stn DW 179, 23°47′ S, 168°17′ E, 400-405 m, 1 dd. — Stn DW 181, 23°18′ S, 168°05′ E, 311-330 m, 1 dd. — Stn DW 197, 23°52′ S, 168°13′ E, 414-436 m, 1 dd.
BERYX 11: stn CH 54, 23°45′ S, 168°17′ E, 390-420 m, 2 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 406, 20°41′ S, 167°07′ E, 373 m, 1 lv.
CALSUB: dive 15, 20°37′ S, 166°58′ E, 538 m, 1 dd.

DISTRIBUTION. — Japan to Philippines; New Caledonia, in 265-540 m, alive in 305-500 m.

REMARKS. — This is the first record of *C. profundorum* from Melanesia. Largest specimen measures 72 mm in length.

Conus profundorum has been synonymized with *C. smirna* by WALLS (1979). However, both taxa occur sympatrically off the coast of New Caledonia. *Conus smirna* is more elongate (RD 0.49-0.53 vs. 0.60-0.63 in *C. profundorum*) and has a higher spire (RSH 0.21-0.28 vs. 0.16-0.17 in *C. profondorum*). Apart from this difference in shape, both species differ in their colouration. *Conus smirna* has brown axial streaks which are lacking in *C. profundorum*. Shells of the latter from the New Caledonian region generally have a broader last whorl than shells from other regions (RD 0.60-0.63 vs. 0.54-0.57).

Conus raoulensis Powell, 1958

Fig. 42

Conus (*Kermasprella*) *raoulensis* Powell, 1958: 83, pl. 9, fig. 1.
Conus raoulensis – MARSHALL, 1981: 495, figs 3a-c.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 255, 25°15′ S, 159°55′ E, 280-295 m, 1 dd.

Source : MNHN, Paris

DISTRIBUTION. — Norfolk Island to Wanganella Bank and Kermadec Islands; New Caledonia, dead in ca. 280 m.

REMARKS. — The single specimen from the Coral Sea is subadult (14.5 × 6.0 mm) and colourless. It cannot be unequivocally identified as *Conus raoulensis*, as *C. raoulensis* and *C. howelli* are sometimes indistinguishable (MARSHALL, 1981). However, the specimen from the Coral Sea is strongly sculptured, a character typical of *C. raoulensis*. It is the first record of this species from Melanesia.

Conus richeri Richard & Moolenbeek, 1988

Fig. 17

Conus richeri Richard & Moolenbeek, 1988: 233, pl. 1, figs 1-5, 10.
Conus gabelishi — RICHER DE FORGES & ESTIVAL, 1986: 15, figs.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 284, 24°10′ S, 159°33′ E, 225-230 m, 1 dd.
New Caledonia. LAGON: stn 378, 22°40′ S, 167°10′ E, 70-72 m, (paratype MNHN). — Stn 387, 22°39′ S, 167°07′ E, 225 m, 1 spm. — Stn 500, 19°04′ S, 163°30′ E, 225 m, 1 dd (holotype MNHN). — Stn 537, 19°07′ S, 163°22′ E, 200 m, 1 dd. — Stn 1146, 19°08′ S, 163°31′ E, 185 m, 1 dd. — Stn 1147, 19°08′ S, 163°30′ E, 210 m, 1 dd. — Stn 1148, 19°07′ S, 163°30′ E, 220 m, 1 spm.
MUSORSTOM 4: stn DW 185, 19°06′ S, 163°29′ E, 230 m, 4 spms (paratypes ZMA 388017, NMNZ). — Stn DW 186, 19°07′ S, 163°30′ E, 190 m, 9 dd. — Stn CP 189, 19°07′ S, 163°29′ E, 210 m, 5 dd. — Stn DW 205, 22°38′ S, 167°07′ E, 140-160 m (paratype AMS). — Stn DW 207, 22°39′ S, 167°07′ E, 220-235 m, (paratype MNHN).
SMIB 1: stn DW 2, 22°52′ S, 167°13′ E, 415 m, 2 dd.
SMIB 2: stn DW 15, 22°53′ S, 167°11′ E, 375-402 m, 1 dd.
SMIB 4: stn DW 57, 23°22′ S, 168°05′ E, 210-260 m, 1 dd.
SMIB 6: stn DW 107, 19°08′ S, 163°30′ E, 195-205 m, 1 dd. — Stn DW 108, 19°07′ S, 163°30′ E, 210-220 m, 3 dd. — Stn DW 112, 19°06′ S, 163°30′ E, 220-225 m, 5 dd. — Stn DW 128, 19°06′ S, 163°22′ E, 205-215 m, 1 dd.

DISTRIBUTION. — New Caledonia and Chesterfield Islands, in 70-415 m (dead).

REMARKS. — *Conus richeri* was misidentified as *C. gabelishi* by RICHER DE FORGES & ESTIVAL (1986). The latter species has a mamillated protoconch (less than 2 whorls, maximum diameter 1.1-1.2 mm vs. about 3 whorls, maximum diameter 0.8 mm in *Conus richeri*), a lighter shell, attaining a maximum length of 35 mm, and a much broader last whorl (RD 0.64-0.71 vs. 0.53-0.60).

Conus smirna Bartsch & Rehder, 1943

Fig. 21

Conus smirna Bartsch & Rehder, 1943: 87.
Conus smirna — MARSHALL, 1981: 499, figs 3 h-j. — RICHER DE FORGES & ESTIVAL, 1986: 16, fig.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 197, 18°51′ S, 163°21′ E, 550 m, 1 dd.
CHALCAL 2: stn CC 1, 24°55′ S, 168°22′ E, 500 m, 2 dd. — Stn DW 74, 24°40′ S, 168°38′ E, 650 m, 1 dd. — Stn DW 75, 24°39′ S, 168°40′ E, 600 m, 1 dd.

Source : MNHN, Paris

SMIB 3: stn DW 1, 24°56′ E, 168°22′ E, 520 m, 2 dd. — Stn DW 9, 24°42′ S, 168°08′ E, 265 m, 1 dd. — Stn DW 21, 22°59′ S, 167°19′ E, 525 m, 2 dd.
SMIB 4: stn DW 38, 24°54′ S, 168°22′ E, 510 m, 1 dd. — Stn DW 50, 23°42′ S, 168°01′ E, 260-295 m, 1 dd. — Stn DW 62, 23°00′ S, 167°22′ E, 490-540 m, 1 dd. — Stn DW 63, 22°59′ S, 167°21′ E, 580 m, 2 dd. — Stn DW 65, 22°55′ S, 167°15′ E, 400-420 m, 1 dd.
SMIB 8: stn DW 150, 24°54′ S, 168°22′ E, 519-530 m, 1 dd. — Stn DW 167, 23°38′ S, 168°43′ E, 430-452 m, 1 dd. — Stn DW 169, 23°37′ E, 168°42′ E, 447-450 m, 1 spm. — Stn DW 187, 23°17′ S, 168°06′ E, 390-540 m, 1 spm.
Loyalty Islands. MUSORSTOM 6: stn DW 410, 20°38′ S, 167°07′ E, 490 m, 1 dd. — Stn CP 467, 21°05′ S, 167°32′ E, 575 m, 1 dd.
CALSUB: dive 9, 20°53′ S, 167°03′ E, 256 m, 1 dd.
New Hebrides Arc. VOLSMAR: stn DW 5, 22°26′ S, 171°46′ E, 620-700 m, 3 dd. — Stn DW 37, 22°22′ S, 168°42′ E, 500-550 m, 1 dd.

DISTRIBUTION. — Hawaii, New Zealand (Wanganella Bank, Kermadec Ridge), and New Caledonia, dead in 255-650 m.

REMARKS. — The specimens from New Caledonia agree with the holotype of *Conus smirna* from Kauai, Hawaii, in size and shape, but they differ in being more ventricose, lacking spiral grooves on spire whorls, and in the axial as well as spiral arrangement of their colour pattern. Provisionally we consider them a local form of *C. smirna*.

Conus stupa (Kuroda, 1956)

Fig. 43

Embrikena stupa Kuroda, 1956: 1-3, pl. 1, fig. 1.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 255, 25°15′ S, 159°55′ E, 280-295 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 392, 20°47′ S, 167°05′ E, 340 m, 1 lv. — Stn CP 464, 21°02′ S, 167°32′ E, 430 m, 1 lv.

DISTRIBUTION. — Japan to Philippines, Solomon Islands, and New Caledonia in 295-430 m, alive in 390-430 m.

REMARKS. — This is the first record of *C. stupa* from the New Caledonia region. The largest specimen (77.7 × 34.6 mm) differs from specimens from the other regions (Japan to Philippines, Solomon Islands) by its lighter weight (0.37 g/mm vs. 0.60-0.70 g/mm) and its narrower last whorl (RD 0.60 vs. 0.63-0.73).

Conus sugimotonis Kuroda, 1928

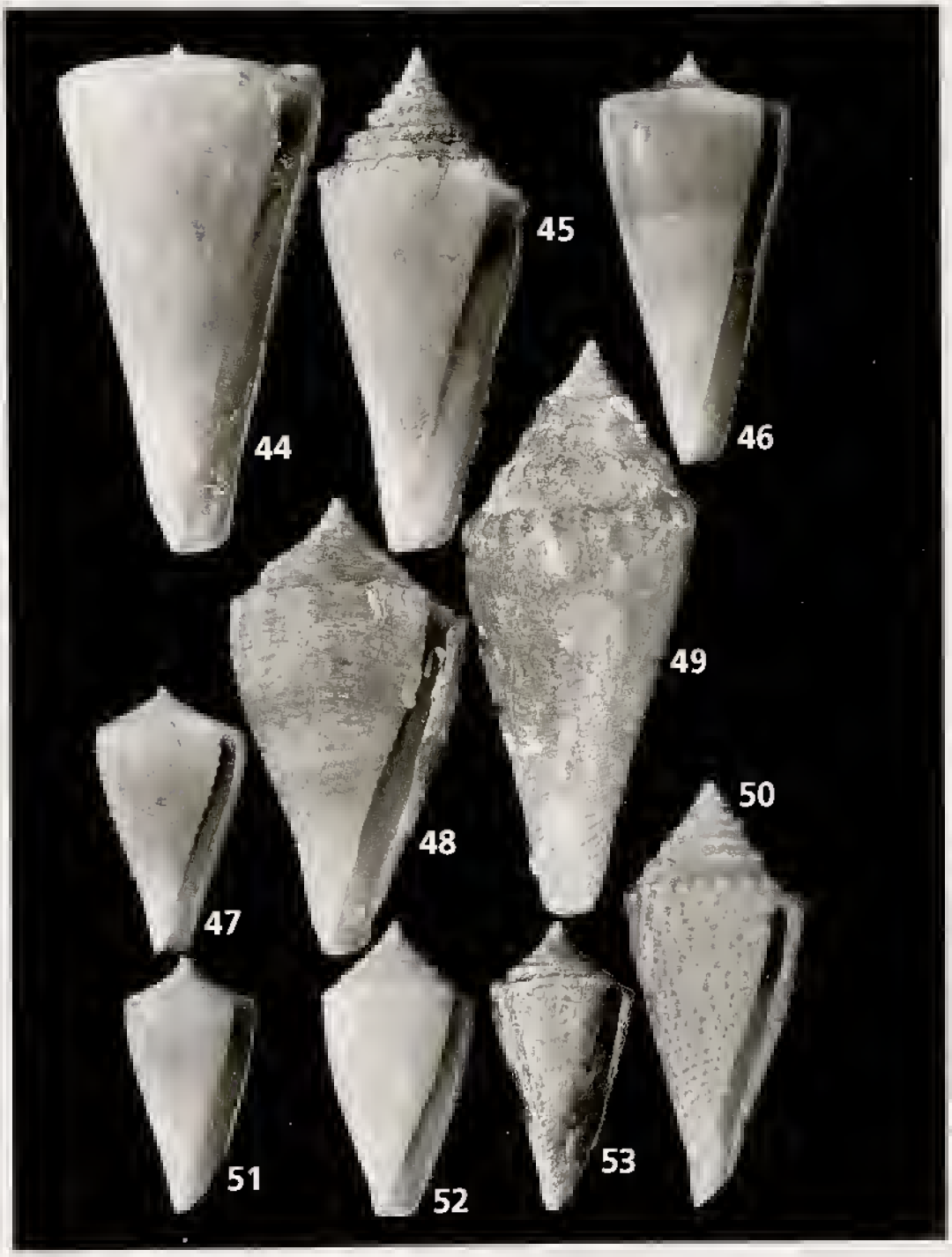
Fig. 44

Conus sugimotonis Kuroda, 1928: pl. 1, fig. 6; 1929: 81.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 274, 24°45′ S, 159°41′ E, 285 m, 1 lv. — Stn CP 311, 22°14′ S, 159°24′ E, 320 m, 1 dd.

DISTRIBUTION. — Japan to Philippines and Queensland; now New Caledonia, in 285 (live) - 320 m.

Source : MNHN, Paris



FIGS 44-53. — **44**, *Conus sugimotonis*, Coral Sea, MUSORSTOM 5: stn 274, 66.7 × 36.0 mm. — **45**, *Conus teramachii*, Coral Sea, MUSORSTOM 5: stn 364, 68 × 28.5 mm. — **46**, *Conus tribblei queenslandis*, New Caledonia, MUSORSTOM 4: stn DW 149, 46.6 × 29.9 mm. — **47**, *Conus species* A, South New Caledonia, CHALCAL 2: stn DW 83, 16.3 × 9.6 mm. — **48**, *Conus species* B, Coral Sea, MUSORSTOM 5: stn 266, 29.3 × 15.6 mm. — **49**, *Conus species* C, New Caledonia, MUSORSTOM 4: st DW 224, 43.2 × 18.2 mm. — **50**, *Conus species* D, Coral Sea, CHALCAL 1984: stn D 11, 22.5 × 9.8 mm. — **51**, *Conus species* E, New Hebrides Arc, VOLSMAR: stn DW 17, 14.7 × 7.6 mm. — **52**, *Conus species* F, South New Caledonia, SMIB 4: stn DW 57, 19.2 × 10.2 mm. — **53**, *Conus species* G, South of Vanuatu, GEMINI: stn DW 49, 17.3 × 8.3 mm.

Source : MNHN, Paris

REMARKS. — This is the first record of this species from Melanesia. The specimen from Coral Sea (66.7 × 36.0 mm) is suffused with very pale violet like specimens from Queensland described as *Conus whiteheadae* Da Motta, 1985. Provisionally, we consider this colour pattern is part of the variability of the species, and does not warrant formal nomenclatural recognition.

Conus teramachii (Kuroda, 1956)

Fig. 45

Asprella (*Endemoconus*?) *teramachii* Kuroda, 1956: 8-9, pl. 1, fig. 4.
Conus teramachii — MARSHALL, 1981: 499.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn CP 364, 19°45′ S, 158°47′ E, 675 m, 1 lv.
Loyalty Islands. MUSORSTOM 6: stn DW 394, 20°49′ S, 167°09′ E, 570 m, 1 dd. — Stn CP 467, 21°05′ S, 167°32′ E, 575 m, 1 dd.

DISTRIBUTION. — South and East Africa from Natal to Somalia, West Australia, Japan to Taiwan, and Australia (Queensland) to North of New Zealand; New Caledonia in 570-675 m, alive in 675 m.

REMARKS. — This is the first record of *C. teramachii* from Melanesia. This species lives in even deeper waters as was prooven by specimens collected by the *"Valdivia"* during the Deutsche Tiefsee-Expedition from depths of 1134 m (dead) and 977 m (live). The present specimens attain a length of 65-70 mm.

Conus tribblei queenslandis Da Motta, 1984

Fig. 46

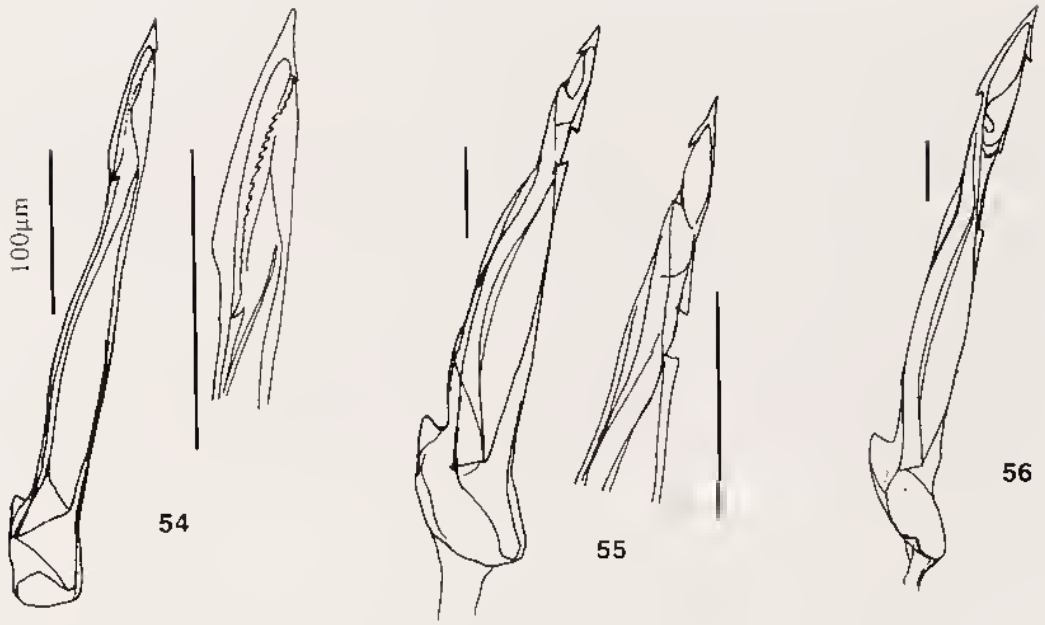
Conus queenslandis Da Motta 1984: 25, text figs 3a-b.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 347, 19°39′ S, 158°28′ E, 260 m, 2 dd.
New Caledonia. LAGON: stn 500, 19°04′ S, 163°30′ E, 225 m, 1 dd.
MUSORSTOM 4: stn DW 149, 19°08′ S, 163°23′ E, 155 m, 1 lv.
CHALCAL 2: stn DW 83, 23°20′ S, 168°05′ E, 200 m, 1 lv.
SMIB 6: stn DW 127, 19°07′ S, 163°23′ E, 190-205 m, 2 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 462, 21°05′ S, 167°27′ E, 200 m, 2 dd.

DISTRIBUTION. — The nominal subspecies *Conus tribblei tribblei* Walls, 1977, from Japan to Philippines, North-West Australia, Solomon Islands; *Conus tribblei queenslandis*, from off the coast of Queensland, Australia, now New Caledonia in 155-260 m, alive in 155-200 m.

REMARKS. — *Conus tribblei queenslandis* can be distinguished from the nominate subspecies by its cream to orange-brown colour bands on its last whorl, but neither by its shape nor in its sculpture, as suggested by DA MOTTA (1984). We consider it a geographical subspecies of *C. tribblei*. It is the first record of this subspecies in Melanesia.

Source : MNHN, Paris



FIGS 54-56. — Radulae. — **54**, *Conus gondwanensis*. — **55**, *C. loyaltiensis*. — **56**, *C. vaubani*. Scale lines: 100 µm. [Drawings courtesy of Emilio Rolan].

Conus vaubani Röckel & Moolenbeek, sp. nov.

Figs 3, 14-15, 56

TYPE MATERIAL. — Holotype MNHN. Paratypes: 2 MNHN, 1 ZMA 3.94.022, 1 AMS C201721, 1 NMNZ M268544, 1 DR.

TYPE LOCALITY. — South New Caledonia, CHALCAL 2, stn DW 77, 23°38′ S, 167°43′ E, 435 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 8, 20°34′ S, 166°54′ E, 435 m, 1 dd. — Stn DW 46, 22°53' S, 167°17′ E, 570-610 m, 35 dd. — Stn DW 48, 23°00′ S, 167°29′ E, 775 m, 3 dd.
MUSORSTOM 4: stn DW 220, 22°58' S, 167°38′ E, 505-550 m, 2 dd. — Stn DW 223, 22°57′ S, 167°30′ E, 545-560 m, 1 dd.
CHALCAL 2: stn DW 76, 23°41′ S, 167°45′ E, 470 m, 9 dd. — Stn DW 77, 23°38′ S, 167°43′ E, 435 m, 1 lv (holotype), 1 spm (paratype ZMA 29.3 × 13.4 mm).
SMIB 2: stn DW 10, 22°55′ S, 167°16′ E, 490-495 m, 1 dd (paratype MNHN, 19.8 × 9.7 mm). — Stn DC 26, 22°59′ S, 167°23′ E, 500-535 m, 1 dd.
SMIB 3: stn DW 12, 23°38′ S, 167°42′ E, 470 m, 1 spm. — Stn DW 21, 22°59′ S, 167°19′ E, 525 m, 16 dd. — Stn DW 23, 22°58′ S, 167°20′ E, 530 m, 3 dd.
SMIB 4: stn DW 60, 23°00′ S, 167°22′ E, 500-535 m, 1 dd (paratype NMNZ, 22.8 × 10.4 mm), 1 spm (paratype AMS, 20.7 × 9.5 mm).
SMIB 8: stn DW 166, 23°38′ S, 167°43′ E, 433-450 m, 3 dd. — Stn DW 168, 23°38′ S, 168°43′ E, 433-450 m, 1 dd (paratype DR, 24.7 × 10.7 mm). — Stn DW 169, 23°37′ S, 168°42′ E, 447-450 m, 1 dd (paratype MNHN, 24.3 × 10.4 mm).
BERYX 11: stn CP 31, 23°39′ S, 167°44′ E, 430-440 m, 1 lv.
New Hebrides Arc. VOLSMAR: stn DW 5, 22°26′ S, 171°46' E, 620-700 m, 2 dd.

Source : MNHN, Paris

DISTRIBUTION. — South New Caledonia (Norfolk Ridge) to the New Hebrides Arc, in 435-775 m, alive in 435-440 m.

DESCRIPTION. — Holotype shell length 25.8 mm, width 11.7 mm; aperture height 20.1 mm. Shell small and narrowly conical (RD 0.58). *Protoconch* of 1.75 whorls, maximum diameter 0.95 mm. Spire of moderate height (RSH 0.22), consisting of 7.5 postnuclear whorls. Whorls tuberculate. Postnuclear sutural ramps straight or sligthly concave, with 8-9 weak spiral grooves or fine striae on late whorls. Spire outline slightly sigmoid. Shoulder angulate with axial costae. Last whorl conical, attenuated near base. Siphonal canal often deflected to the dorsal side. Fine axial ribs basally, gradually changing to fine and almost obsolete spiral striae up to shoulder. Ground colour white, with light brown axial streaks from base to the last spire whorl. Spire whorls with some irregular brown spots.

Radula with 40 large teeth (0.82-0.95 mm for 22.9-29.3 mm shells). Base oblique.

REMARKS. — Shell length of paratypes and other specimens 20-29 mm, last whorl conical to broadly conical (RD 0.58-0.62; RD of 2 shells from Hunter and Matthew about 0.64-0.65). Spire moderately high (RSH 0.22-0.27). Maximum diameter of protoconch 0.9-1.1 mm. Outline of spire concave to sigmoid. Number of postnuclear whorls 7-8. Nodulation of spire whorls may be restricted to the first 4-5 postnuclear whorls; shoulder with axially oriented ribs or smooth, angulate or carinate. Last whorl conical to slightly pyriform. Colour pure white or with brown axial blotches or streaks. Periostracum yellowish brown, thin, translucent.

Conus vaubani resemble *C. ikedai* Ninomiya, 1987, *C. jeanmartini* (Raybaudi, 1992), *C. smirna* and *C. profundorum*, the last two of which are sympatric with it in New Caledonia. *Conus ikedai*, known only from its type locality, Sagami Bay, Japan, is of similar size (L 25-30 mm), but differs in having only 5 (instead of 7-8) postnuclear whorls of which only 3 are tuberculate; its shoulder is rounded, and its periostracum is white (NINOMIYA, 1987). *Conus smirna* can be distinguished by its larger size (length to about 100 mm), multispiral and brown protoconch, convex spire outline, and the absence of spiral grooves on postnuclear whorls. *Conus profundorum* differs in having a multispiral protoconch (more than 3 whorls) and a brownish beige colour pattern with a white central band. *Conus jeanmartini*, from off Réunion, differs by having a higher, more stepped and more strongly nodulated spire. Later postnuclear whorls are straight to slightly concave, without regular spiral grooving.

ETYMOLOGY. — The cruises MUSORSTOM 4 and SMIB 1, 2, and 3 have been carried out aboard the R.V. *"Vauban"*.

SPECIMENS NOT ASSIGNABLE TO KNOWN SPECIES

Conus species A

Fig. 47

MATERIAL EXAMINED. — **New Caledonia**. SMIB 4: stn DW 46, 24°47′ S, 168°09′ E, 245-260 m, 1 dd.
CHALCAL 2: stn DW 69, 260 m, 1 dd. — Stn DW 83, 23°20′ S, 168°06′ E, 200 m, 1 dd.

REMARKS. — Shell small (length 16.3-22.5 mm), outline of spire straight, maximum diameter of protoconch 0.9-1.0 mm. Spire whorls and shoulder tuberculate, sutural ramp with 2-4 spiral grooves. Last whorl pyriform with about 12 granulated ribs. Colour white or slightly pink on both sides of centre. Resembles *Conus alisi* in colour and outline but the granulations and a smaller protoconch separate it from that species.

Source : MNHN, Paris

Conus species B

Fig. 48

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 266, 25°20′ S, 159°46′ E, 240 m, 1 dd.

REMARKS. — Shell moderately small (length 29.3 mm); outline of spire concave; first 6 postnuclear whorls tuberculate, last whorls smooth and keeled. Sutural ramp with 4 strong spiral grooves. Last whorl pyriform, with about 25 spiral grooves and strong granulated spiral ribs. Colour white with 3 light brown spiral bands, shoulder regularly dotted. *Conus wakayamaeusis*, *C. baileyi* and *C. pagodus* are similar. *Conus wakayamaensis* can be distinguished by the almost straight sides of the last whorl, arcuate radial threads on sutural ramps and a less sculptured last whorl. *Conus baileyi* differs in having a narrower (RD 0.51-0.62 vs. 0.68), more conical, and less sculptured last whorl. *Conus pagodus* has smooth ribbons on its last whorl, its sutural ramps are deeply concave, and the spiral grooves on sutural ramps are crossed by radial riblets.

Conus species C

Fig. 49

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 224, 22°55′ S, 167°27′ E, 575-595 m, 1 dd.

REMARKS. — Shell medium sized (length 43.2 mm); outline of spire straight. Maximum diameter of protoconch about 0.8 mm; spire high (RSH 0.30), whorls and shoulder coronate. Sutural ramp concave with 8-10 weak spiral grooves on later whorls. Last whorl with 15-20 spiral striae basally, which diminish toward the shoulder. Colour white. The sympatric *Conus teramachii* is less biconic and has more stepped spire whorls. Additional material and research may prove whether *Conus* species C is an aberrant specimen.

Conus species D

Fig. 50

MATERIAL EXAMINED. — **Chesterfield Islands**. CHALCAL 1: stn DC 11, 20°32′ S, 161°07′ E, 83 m, 1 dd.

REMARKS. — Shell small (length 22.5 mm) and heavily eroded; outline of spire slightly concave. Spire slightly scalariform, spire whorls and shoulder finely tuberculate. Sutural ramps with about 4 spiral grooves. Last whorl conical, outline slightly concave to pyriform, with about 30 spiral grooves and granulated ribs in between. Colour white.

Conus species E

Fig. 51

MATERIAL EXAMINED. — **New Hebrides Arc**. VOLSMAR: stn DW 17, 22°23′ S, 171°41′ E, 260-300 m, 1 dd.

Source : MNHN, Paris

REMARKS. — Shell small (length 14.7 mm), eroded; outline of spire concave. Protoconch of more than 3 whorls, maximum diameter 1.0 mm. First 2-3 postnuclear whorls tuberculate, later ramps carinate; sutural ramps with 3 strong spiral grooves. Outline of last whorl sliglty convex above shoulder, last whorl smooth except some spiral cords basally. Colour brownish white. This specimen shows resemblance to *Conus sazanka* Shikama, 1970 which has a less carinate shoulder, an even smaller protoconch and a different colour-pattern.

Conus species F

Fig. 52

MATERIAL EXAMINED. — **New Caledonia**. SMIB 4: stn DW 57, 23°22′ S, 168°05′ E, 210-260 m, 1 spm.

REMARKS. — Shell small (length 19.2 mm); outline of spire straight to slightly concave. Protoconch of about 3.5 whorls, maximum diameter 0.9 mm. Sutural ramps with 2-3 spiral grooves, obsolete in later whorls. Shoulder carinate. Last whorl bulbous to slightly pyriform, smooth except for 8-9 spiral grooves basally. Colour white, with weak brown markings on spire and last whorl.

Conus species G

Fig. 53

MATERIAL EXAMINED. — **New Hebrides Arc**. GEMINI: stn DW 49, 21°00′ S, 170°04′ E, 285 m, 1 dd.

REMARKS. — Shell small (length 17.3 mm); spire of moderate height, outline concave; protoconch of about 2.5 whorls, maximum diameter about 0.8 mm. First 2-3 postnuclear whorls tuberculate, later whorls and shoulder keeled. Last whorl conical with almost straight sides, smooth except base. Colour dark brown to beige, with 6-8 dotted spiral lines.

Identification of this shell is difficult since it is not fullgrown and is eroded. It might be related to the *Conus wakayamaensis-nereis* group.

Conus species H

MATERIAL EXALMINED. — **Loyalty Islands**. MUSORSTOM 6: stn DW 453, 21°01' S, 167°27' E, 250 m, 1 dd. — Stn DW 462, 21°05' S, 167°27' E, 200 m, 1 dd.

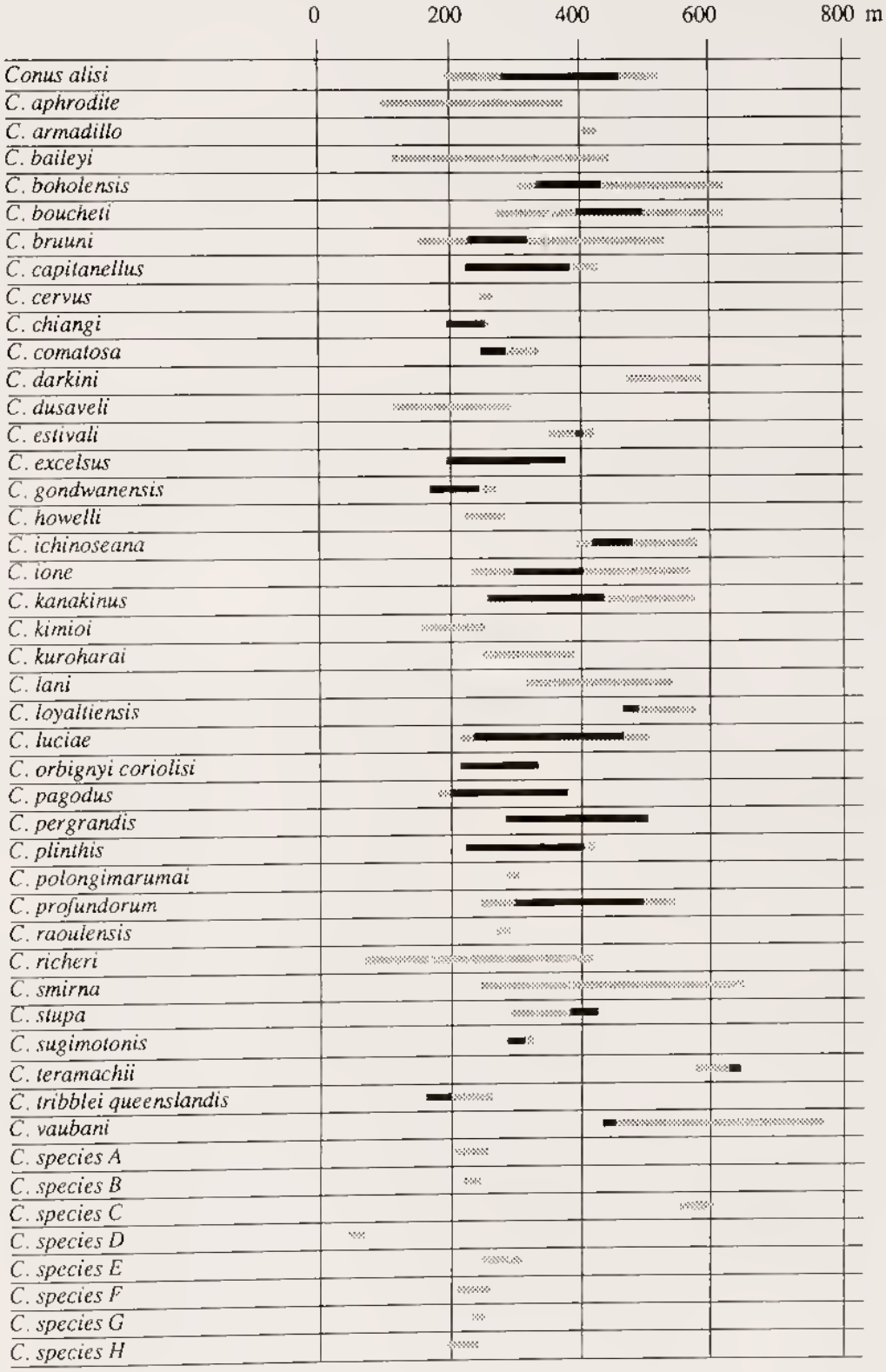
REMARKS. — Our first impression was that these two shells belong to *C. praecellens* A. Adams, 1854. However, a comparison between shallow-water material from the Philippines and these cones from deep-water off the Loyalty Islands convinced us that there are at least two taxa in this complex. The shallow-water species has a paucispiral protoconch whereas the deep-water species has a multispiral protoconch. Additional research has been initiated (MOOLENBEEK & RÖCKEL, in prep.) to disentangle this complex.

SUMMARY OF DISTRIBUTION DATA

The more than 600 records of deep-water *Conus* from the New Caledonia region are summarized in Table 1. Of the 39 identified species, 24 are represented by live taken material, and

Source : MNHN, Paris

TABLE 1. — Bathymetric range of *Conus* species from depths greater than 100 m in the New Caledonian region (New Caledonia, Chesterfield Islands, Loyalty Islands).
Solid bar: confirmed living depth range; stippled: depth range indicated by empty shells only.



Source : MNHN, Paris

15 by empty shells only. Records of empty shells appear to be consistent with live records. Although some records may belong to empty shells carried downslope by water movements, gravity or animals, it is likely that most belong to thanatocoenoses that have accumulated more or less *in situ*.

An examination of the Table shows that the highest diversity is found in the 200-300 m depth interval, with as many as 30 species of *Conus*. Only 12 species are recorded in the 100-200 m depth interval. This is explained by the fact that we have excluded from the present study the species with a main distribution above 100 m, and also because comparatively fewer samples have been taken in this extremely steep and rugged part of the slope. Deeper than 300 m, the number of species recorded decreases to 24, 21, 13, 6 and 2 in the 300-400, 400-500, 500-600, 600-700 and 700-800 m depth intervals, respectively. This does not appear to result from uneven sampling effort, but rather reflect a gradual decrease in *Conus* diversity with increasing depth.

Beside changes in faunal diversity, there are also changes in faunal composition. As many as 24 of the 30 species (80%) recorded from the 200-300 m interval do not occur deeper than 500 m. Conversely, of the 13 species living between 500 and 600 m, 7 (54%) (*Conus boholensis*, *C. darkini*, *C. ichinoseana*, *C. lani*, *C. loyaltiensis*, *C. teramachii* and *C. vaubani*) do not live between 200 and 300 m. This indicates that there are several discrete assemblages that replace each other with depth.

Most deep-water *Conus* in public and private collections come from the shell trade. Many species are recorded from, *e.g.*, the Philippines, but the specimens are extremely rarely accompanied by genuine and reliable indications of depth. In fact, local fishermen collecting cones and other molluscs from tangle nets do not have echo-sounders, and the occasional depth data that accompany some material must be very rough approximations that should be considered with caution. Beside its regional interest, this makes the New Caledonia material an extremely valuable source of knowledge for the deep-water Conidae of the Indo-Pacific in general.

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Source : MNHN, Paris

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Source : MNHN, Paris

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Source : MNHN, Paris

10

Mathildidae from New Caledonia and the Loyalty Islands (Gastropoda: Heterobranchia)

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ABSTRACT

Specimens of the genera *Mathilda* and *Tuba* from New Caledonia and the Loyalty Islands are studied, and compared with numerous other nominal mathildid species from the Indo-Pacific and Atlantic Oceans. Diversity is high in this region, with several species showing a much wider distribution in the Indo-Pacific than previously ascertained. *Mathilda* Semper, 1865 is used *sensu lato*, including *Fimbriatella*, *Granulicharilda*, *Mathildona* and *Opimilda*. From the study area thirteen species are diagnosed and compared, and several as yet unnamed forms that need further study are also discussed. Four new species are described, and *Mathilda fusca* (Okutani & Habe, 1981), previously placed in the turritellid genus *Orectospira*, is recognized as the largest extant member of the family Mathildidae. *Tuba* Leu, 1833 is also used *sensu lato*, including *Gegania* and *Tubena*, and is represented by two species (one described as new).

Twelve Indo-Pacific species previously referred to as Mathildidae are removed from the family: *Mathildona cookiana* Dell, 1956 (Epitoniidae); *Mathilda elegantula* Angas, 1871 (Pyramidellidae ?); *M. eurytima* Melvill & Standen, 1896 (Cerithiidae); *M. gracillima* Melvill & Standen, 1901 (Capulidae); *M. oppia* Hedley, 1907 (Rissoidae); *M. opulenta* Hedley, 1907 (Cerithiidae); *M. rosae* Hedley, 1901 (Eulimidae); *Eucharilda pleurorbis* Laseron, 1951, and *Opimilda protolineata* Laseron, 1951 (Triphoridae); *O. porrigata* Laseron, 1951 (Cerithiopsidae ?); *Dunkeria pulchella* A. Adams, 1860, and *D. scabra* A. Adams, 1860 (Epitoniidae).

RÉSUMÉ

Mathildidae de Nouvelle-Calédonie et des îles Loyauté (Gastropoda: Heterobranchia).

Cette étude porte sur les représentants des genres *Mathilda* et *Tuba*, récoltés récemment en Nouvelle-Calédonie et aux îles Loyauté, dont le matériel est comparé à de nombreuses autres espèces nominales de Mathildidae des océans Atlantique et Indo-Pacifique. La région d'étude montre une richesse spécifique élevée, plusieurs espèces présentant une distribution indo-pacifique beaucoup plus vaste qu'il n'avait été démontré jusqu'ici. Le nom *Mathilda* Semper, 1865 est employé *sensu lato*,

BIELER, R., 1995. — Mathildidae from New Caledonia and the Loyalty Islands (Gastropoda: Heterobranchia). *In*: P. BOUCHET (ed.), Résultats des Campagnes MUSORSTOM, Volume 14. *Mém. Mus. natn. Hist. nat.*, **167** : 595-641. Paris ISBN 2-85653-217-9.

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Source : MNHN, Paris

en y incluant *Fimbriatella*, *Granulicharilda*, *Mathildona* et *Opimilda*. Treize espèces sont recensées, décrites et comparées, auxquelles s'ajoutent plusieurs autres formes dont l'identité requiert l'étude de matériel additionnel. Quatre espèces sont décrites comme nouvelles. *Mathilda fusca* (Okutani & Habe, 1981), jusqu'ici classé dans le genre *Orectospira* (Turritellidae), s'avére être la plus grande espéce actuelle de Mathildidae. Le genre *Tuba* Lea, 1833, également employé *sensu lato* et en y incluant *Gegunia* et *Tubenu*, est représenté par deux espéces, dont l'une décrite comme nouvelle.

Douze espéces indo-pacifiques jusqu'*ici* classées dans les Mathildidae appartiennent en fait á d'autres familles: *Mathildona cookiana* Dell, 1956 (Epitoniidae); *Mathilda elegantula* Angas, 1871 (Pyramidellidae ?); *M. eurytima* Melvill & Standen, 1896 (Cerithiidae); *M. gracillima* Melvill & Standen, 1901 (Capulidae); *M. oppia* Hedley, 1907 (Rissoidae); *M. opulenta* Hedley, 1907 (Cerithiidae); *M. rosae* Hedley, 1901 (Eulimidae); *Euchrilda pleurorbis* Laseron, 1951, et *Opimilda protolineata* Laseron, 1951 (Triphoridae); *O. porrigata* Laseron, 1951 (Cerithiopsidae ?); *Dunkeria pulchella* A. Adams, 1860, et *D. scabra* A. Adams, 1860 (Epitoniidae).

INTRODUCTION

The marine gastropod family Mathildidae is a deep-water group, with about 130 extant nominal species in the Atlantic and Indo-Pacific Oceans. Most currently recognized members have high-spired shells with a sculpture of intersecting axial and (usually stronger) spiral ribs. The fossil record is extensive and the mathildids *sensu lato* are clearly traceable to the Triassic (*e.g.*, GRÜNDEL, 1976; BATTEN & STOKES, 1986). The group is poorly studied, with most nominal species known from their type series only. The last group-wide attempt to monograph *Mathilda* (*sensu lato*) dates from DE BOURY (1883), and thus predates the introduction of all but four nominal extant species here discussed. Like many other unrevised small-shelled gastropod groups, "Mathildidae" has become a waste basket for taxa difficult to place. With many of the nominal genera (including name-bearing *Mathilda*) based on fossil type material, modern studies involving anatomical data on "mathildids" run the risk of selecting nominal family members that in fact belong to different superfamilies, as will be shown below. This paper presents a first taxonomic "house cleaning" in an attempt to make monophyletic subsets available for subsequent studies.

The group is of phylogenetic interest because most of its current members seem to belong to the 'lower heterobranchs,' an assemblage with unresolved relationships to caenogastropods, opisthobranchs and pulmonates (HASZPRUNAR, 1988; BIELER, 1992). Like the presumably closely related Architectonicidae, most species currently classified as mathildids have heterostrophic shells (*i.e.*, the protoconch axis diverges considerably from that of the teleoconch). Only the protoconch in these forms is hyperstrophic (shell growth ascends the axis of coiling, producing apparent sinistrality although the animal is dextrally organized), while the teleoconch has normal orthostrophic growth. This paper is restricted to species with smooth hyperstrophic protoconchs, excluding such supposed mathildid forms as *Brookesena* Finlay, 1926, which need more study. Generic allocations have been made conservatively, grouping the species into *Mathilda* Semper, 1865 (*sensu lato*), and *Tuba* Lea, 1833 (*sensu lato*), which here are redefined.

This paper is the first part of an attempt to revise the species-level taxonomy of Indo-Pacific mathildids. The massive collecting efforts off New Caledonia and the Loyalty Islands, including the 19th century type localities of several nominal mathildid species, have provided a unique opportunity for the study of mathildids. The newly collected material, available type material and other museum specimens are compared in a descriptive fashion, based on shell features. Awaiting the results of ongoing studies on additional species (Atlantic Ocean) and other characters (anatomy), no attempt has here been made to reconstruct phylogenetic relationships at the species-level. Special emphasis was placed on the description and illustration of the spiral rib pattern on the shell, which often shows considerable ontogenetic change. The different conditions of growth stages of the same species had led previous authors to describe separate nominal species, which are here synonymized.

Analogous to the situation found in the Architectonicidae (*e.g.*, BIELER, 1993), and based on the very similar larval shell morphology, mathildid species were suspected to have wide geographic distributions. Beginning with PIANI (1981: 3; presenting additions and corrections to an earlier work [1980: 133]), several authors have implied amphi-Atlantic distribution of a single mathildid species, by synonymizing western Atlantic species with one or several eastern Atlantic and Mediterranean forms (*e.g.*, GARCIA-TALAVERA, 1983; OLIVERIO & NOFRONI, 1986, 1988). Accordingly, the New

Source : MNHN, Paris

Caledonia/Loyalty Islands mathildids have been compared to previously described nominal species from Atlantic and Indo-Pacific Oceans, with special attention to the western Pacific.
Thirteen *Mathilda* (*sensu lato*) species are thus diagnosed and compared; of these, four are described as new species. *Tuba* (*sensu lato*) is represented by two species, one of which is described as new.

MATERIALS AND METHODS

The taxonomic data for this work were derived largely from the study of more than 100 specimens newly collected as part of different dredging expeditions in New Caledonia as summarized by RICHER DE FORGES (1990, 1991, 1993) and ROUX *et al.* (1991). In addition, other museum material from the Indo-Pacific and Atlantic Oceans was studied.

Type material: All available type specimens of nominal extant species covered by this monograph were examined. An exception are the eight species-group taxa that were originally described from Japan. They are presently located in private collections or are part of the 'Imperial Household' and were not available on loan for this study. Although some photographs and topotypic specimens have been obtained through the kind cooperation of Japanese colleagues to augment the sometimes insufficient original descriptions, it should be noted that the taxonomic treatment of these particular taxa is not based on direct study of type material.

Scanning electron microscopy (SEM): Previously described type material and other unique specimens received on loan without permission for gold coating were studied and photographed under SEM *without* coating. These specimens were temporarily mounted on stubs with adhesive tabs, commercially available from SEM supply vendors. Excessive 'charging' of these samples was avoided by reducing the accelerating voltage to 2-6 kV. This resulted in an unavoidable loss of resolution, especially in case of larger specimens for which the microscope stage had to be lowered (causing greater working distance). Other specimens were coated with gold. Most specimens were observed and photographed using an AMRAY 1810 scanning electron microscope at Field Museum. Some large specimens were photographed in sections (using a Zeiss Novascan-30 model at the Smithsonian Marine Station, Ft. Pierce, Florida), with the partial images later combined into composite prints. Differences in resolution and contrast among illustrations are a result of this mixture of coated and uncoated material. To allow direct comparison between illustrated specimens, certain aspects were photographed at consistent magnification (teleoconch apex at 25x, protoconch at 72x).

Descriptions and measurements: For the majority of the specimens studied, the following characters were observed and recorded (using calipers and a dissecting microscope with a calibrated eyepiece at 50x magnification; mm accuracy given in parentheses): teleoconch diameter (0.1), shell height (0.1), protoconch diameter (0.02), anal keel length (0.02), number of teleoconch whorls (1/8 of a whorl or better, indicated by trailing "+" or "−"), position of the upper point of whorl attachment (and thus the depth of the suture); spire angle; apical, peripheral, basal, and umbilical sculpture; coloration of proto- and teleoconch (for the latter as ground color plus pattern on the various sculptural elements). In addition, notes were compiled on characters of the periostracum and operculum, and on the shape and degree of heterostrophy of the protoconch. This degree of heterostrophy is given as the angle of deviation between the axes (with 5° accuracy). A completely orthostrophic growth pattern would thus be indicated by 0°, a completely "upside-down" protoconch by 180° heterostrophy.

Teleoconch (= shell) diameter was recorded as the greatest dimension perpendicular to the columellar axis. 'Protoconch diameter' is the maximum protoconch diameter. It should be noted that this is the actual maximum diameter in forms with largely exposed protoconchs (*i.e.*, forms of *Mathilda* [*sensu lato*]), while it represents the maximum exposed diameter in *Tuba*. Shell height is the greatest dimension parallel to the columellar axis, measured from the apex (including protoconch) to

Source : MNHN, Paris

the base of the aperture. Teleoconch whorls were counted from the outer corner of the line demarcating the border between proto- and teleoconch to the farthest extent of the periphery (= the point of the outer lip utilized to measure greatest shell diameter). The number of protoconch whorls was determined by the method of TAYLOR (1975: 10; summarized by JABLONSKI & LUTZ, 1980: 332, fig. 4). Aberrant specimens with obviously distorted or repaired shells were measured but the results were not used in descriptions or statistics.

The ontogenetic development of spiral sculptural elements is shown in graphs (*e.g.*, Figs 8-9, 14, 27), delineating relative position, major differences in strength and, most of all, the sequence of occurrence. The sequence follows the concept and is directly comparable with earlier schemes employed in turritellid and mathildid works, *e.g.* that of GRÜNDEL (1976) who used it for several mathildid species. The labelling of ribs is purely descriptive, identical numbers in different species do not necessarily imply homology.

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

AIM : Auckland Institute and Museum
AMS : Australian Museum, Sydney
ANSP : Academy of Natural Sciences, Philadelphia
BMNH : The Natural History Museum, London
DMNH : Delaware Museum of Natural History, Wilmington
FMNH : Field Museum of Natural History, Chicago
HUJ : Zoological Museum, Hebrew University, Jerusalem
MNHN : Muséum national d'Histoire naturelle, Paris
MUM : The Manchester [University] Museum
NMNZ : Museum of New Zealand Te Papa Tongarewa, Wellington
NMP : Natal Museum, Pietermaritzburg
NMW : National Museum of Wales, Cardiff
NSMT : National Science Museum, Tokyo
USNM : National Museum of Natural History, Washington, DC
ZMA : Zoölogisch Museum, Amsterdam
ZMB : Museum für Naturkunde, Humboldt-Universität, Berlin

Other abbreviations

dd : dead-collected, empty shell (under 'Material examined')
lv : live-collected specimen (under 'Material examined')
D : Diameter (mm)
H : Height (mm)
PD : Protoconch diameter (µm)
TW : Teleoconch whorls (number)
OD : Original designation
SD : Subsequent designation.

Source : MNHN, Paris

SYSTEMATIC ACCOUNT

HETEROBRANCHIA Gray, 1840

Superfamily ARCHITECTONICOIDEA Gray, 1840

Family MATHILDIDAE Dall, 1889

Genus *MATHILDA* Semper, 1865

Mathilda Semper, 1865a: 330. Type species (SD by DE BOURY, 1883: 112): *Turbo quadricarinatus* Brocchi, 1814; Pliocene, Italy.

DIAGNOSIS for *Mathilda* (*sensu lato*) (shell characters). — *Protoconch*: diameter 440-640 µm; hyperstrophic, diverging about 100-145° from teleoconch axis; with 1.5 to 2.5 whorls; smooth, glassy, without distinct sculptural elements other than short, curved anal keel and thin callus, the latter covering the protoconch umbilicus (noticeable only in well-preserved specimens); transparent or milk-white with tan pigmentation often on embryonic whorl, suture, anal keel and callus.

Teleoconch: length usually 3-20 mm at 4 1/4 to 14 whorls, but large-shelled forms occasionally up to 40 mm at 19 whorls; slender to broadly cone-shaped, spire angle 17-38°; upper side with concave, straight or slightly bulging whorls; periphery with single or double keel or rounded; aperture round to quadrangular, apertural lip often slightly channeled at columella and under major spiral ribs of body whorl; first teleoconch whorl already with at least a subset of the adult axial and spiral sculpture; exposed primary sculpture on upper side consisting of 3 to 4 spiral ribs (often with interspaced additional ones), 1 or 2 of the main spiral ribs markedly more prominent than the others; spiral ribs crossed (at right angles or following more-or-less sinuous shape of apertural lip) by weaker axial ribs, threads or enhanced growth lines; at rib intersections usually with sculpture of rounded more-or-less coarse nodules; interspaces between spiral ribs cancellate due to axial ribbing; upper point of attachment of the following whorl at a spiral rib less prominent than at least one of the exposed ribs above; this attachment rib and an additional rib next to it forming a distinct double edge at outer shell base; flat, concave or slightly inflated basal area with several more-or-less well-defined spiral threads or ribs, surrounding solid columella, or narrow umbilical chink, or funnel-shaped umbilicus; coloration white, overall tan or marbled brown, with distinct brown blotches, or with spiral pattern of various shades of brown.

REMARKS. — **Type species designation.** In his discussion of the new genus *Mathilda*, SEMPER (1865a: 328-330) focused on the species *Turbo quadricarinatus* Brocchi, implying but not clearly stating that this species was to form the type of his new genus. While some authors (*e.g.*, WRIGLEY, 1940: 10; HARRIS & PALMER, 1947: 234) accepted this as an original designation, others cited various works by COSSMANN (1888, 1912) for subsequent designations (*e.g.*, GRÜNDEL, 1976: 349; WENZ, 1939: 661). The earliest type designation appears to be the one by DE BOURY (1883: 112), who clearly stated: "Type: *Turbo quadricarinatus*, Brocchi" (see also MACNEIL & DOCKERY, 1984: 55).

Spelling of *Mathilda*, *Promathilda* and Mathildidae. ANDREAE (1887: 23) introduced the name "*Promathildia*" for what he interpreted as Jurassic precursors of the younger genus *Mathilda* Semper, which he misspelled "*Mathildia*". Since he clearly intended to combine the preposition "pro-" with SEMPER's generic name, "*Promathildia*" is here regarded as merely an incorrect original spelling (ICZN Art. 32c) of *Promathilda*, without separate nomenclatural availability in its original form (ICZN Art.32[c-d]); see also ZITTEL (1900: 457), WENZ (1939: 660) and HAAS (1953: 185). The intentional emendation to *Mathildia* by several authors (COSSMANN, 1888: 309; 1912: 8; KRACH, 1963: 87) is

Source : MNHN, Paris

unjustified (ICZN Art. 33b [iii]). DALL (1889: 266) spelled the generic name as "*Mathilda*", but gave the family name as "Mathildiidae"; the latter is thus interpreted as an incorrect original spelling. DALL appears to be the first of several authors who have proposed this family name (*e.g.*, also SACCO 1892: 27).

Mathilda sensu lato. GRÜNDEL (1973) distinguished three subgroups of *Mathilda*, based on the number of primary spiral ribs (2, 3 or 4 "Primärspiralen", referring to the spiral ribs beginning on the early teleoconch whorls). However, as GRÜNDEL himself pointed out (1973: 949), it remains untested whether the members of these respective groups are indeed monophyletic. *Mathilda s. s.* was defined by GRÜNDEL as always having four primary spiral ribs, the third and fourth of which more strongly developed and often of equal strength. This pattern is referred to as "2+2" in the following descriptions. However, several other rib arrangement patterns were encountered during this study. Pending further anatomical investigations, the present paper addresses the group *Mathilda* (*sensu lato*), which is here understood to also include the following nominal genus-group taxa:

Fimbriatella Sacco, 1895: 36. Type species (OD): *Cerithium fimbriatum* Michelotti, 1847, which was erroneously given as "*F. fimbriatella* (Micht.)" and subsequently corrected to "*Fimbriatella fimbriata* (Micht.)" by SACCO (1896: 81).

Granulicharilda Kuroda & Habe *in* Kuroda, Habe & Oyama, 1971: 416, 260. Type species (OD): *Granulicharilda sagamiensis* Kuroda & Habe *in* Kuroda, Habe & Oyama, 1971; see below.

Mathildona Iredale, 1929: 186. Type species (OD): *Mathildona euglypta* Iredale, 1929; see below under *Mathilda decorata*. *Opimilda* Iredale, 1929 (: 187, 189) is a subjective synonym of *Mathildona*. Type species (OD): *Mathilda decorata* Hedley, 1903; see below under *M. decorata*.

Mathilda brevicula Bavay, 1922

Figs 1-3, 8

Mathilda brevicula Bavay, 1922: 65, pl. 1, fig. 11.

TYPE MATERIAL. — BAVAY (1922) did not select a holotype nor did he indicate the number of specimens under study. The figured syntype (in the original and here in Fig. 1; H= 3.8, D= 2.2, PD= 480 µm, TW= 5 1/10; MNHN) is selected as lectotype of *Mathilda brevicula*.

TYPE LOCALITY. — "Loyalty insulas" given in original description. Original specimen label states "Lifou, Nouvelle-Calédonie".

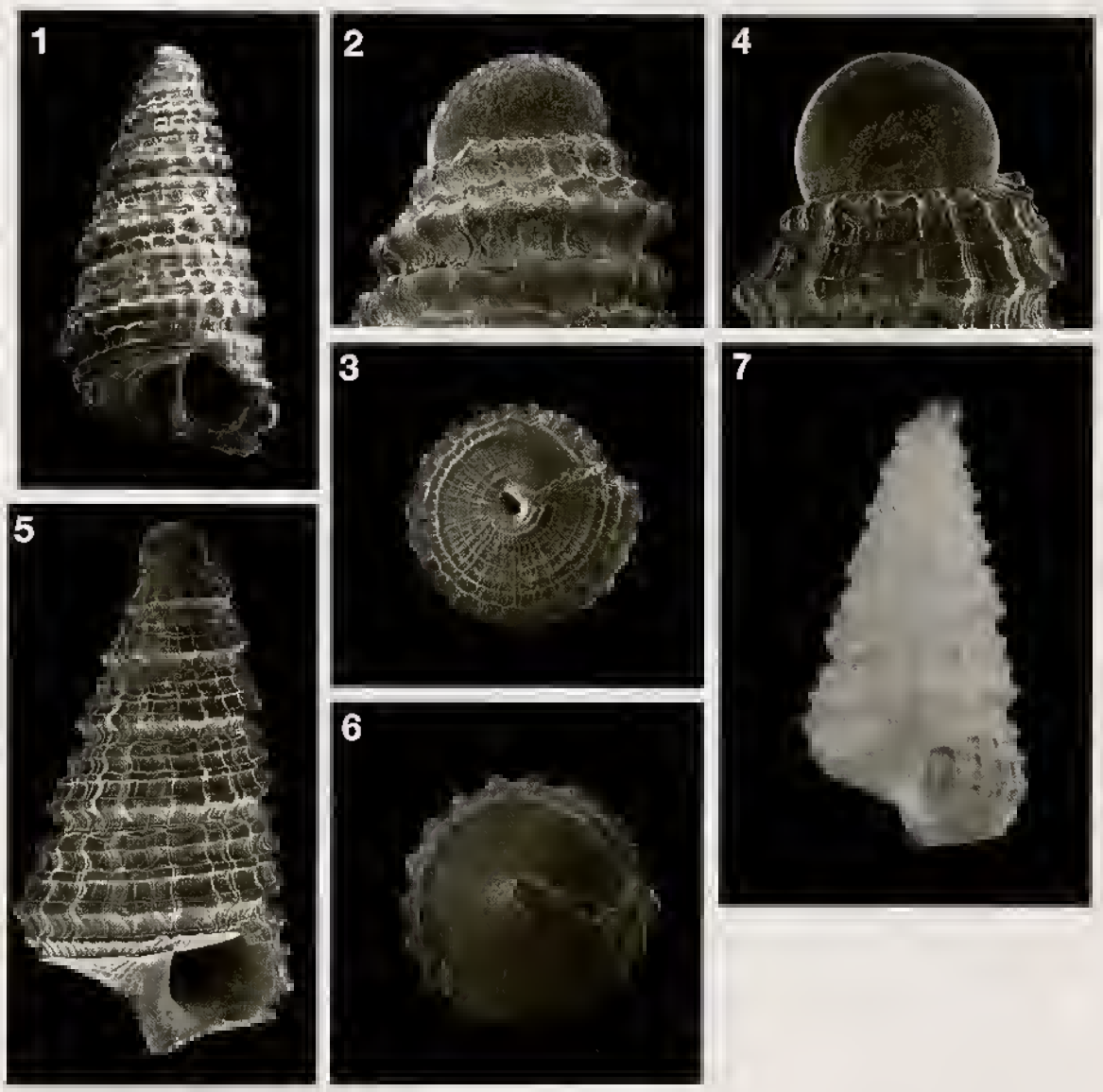
MATERIAL EXAMINED. — **Loyalty Islands**. Lectotype as above, no depth given.
New Caledonia. LAGON: stn 830, 20°49′ S, 165°19′ E, 105-110 m, 1 dd.
South Coral Sea. Elizabeth Reef, stn 30, 29°57.2′ S, 159°01.2′ E, 12-17 m, 10.XII.1987, P. Hutchings coll., 1 dd (AMS C155488).

DISTRIBUTION. — Not known from outside this study area; depth 12-110 m; no live material collected.

DESCRIPTION. — *Protoconch* (Fig. 2): smooth, globular, strongly hyperstrophic, at about 135° angle to teleoconch axis; embryonic whorl not exposed, suture hidden or only small part of suture exposed; number of whorls not ascertained; PD 480-520 µm; with weak peritreme. Protoconch umbilicus completely covered by thin callus, extending between first TW and anal keel. Glassy or milk-white; area before protoconch lip and callus tan.

Teleoconch: slender cone-shaped, base acutely angled; 3.1-3.8 mm at 4 1/2 to 5 1/10 whorls, spire angle 30-34°. Pattern of regular spiral and weaker axial ribs, intersecting at slightly oblique angles to form strong nodules. Spacing of the axials very regular, with ca. 21-24 on fourth whorl. Exposed upper part of earlier whorls with 3 spiral ribs (middle one weakest, lowermost strongest), joined (below the uppermost) by a weak additional rib(s) at about 3 1/2 to 4 1/2 TW (Fig.

Source : MNHN, Paris



FIGS 1-7. — **1-3**, *Mathilda brevicula* (SEM, uncoated). — **1**, lectotype, Loyalty Islands, 3.8 mm; specimen slightly tilted. — **2**, protoconch and first teleoconch whorl, specimen from New Caledonia, LAGON: stn 830, protoconch diameter 520 µm. — **3**, same specimen, shell base with open umbilicus, diameter 2.6 mm. — **4-7**, *Mathilda boucheti* sp. nov. — **4-6**, paratype 1, New Caledonia, FMNH 224968. — **4**, aspect of protoconch and first teleoconch whorl, protoconch diameter 600 µm. — **5**, lateral aspect, 4.6 mm. — **6**, shell base, 2.3 mm diameter. — **7**, holotype, New Caledonia, 5.0 mm (light photograph).

8). Upper point of whorl attachment at a recessed, fourth spiral rib, partly covering it. On body whorl, this rib, and one of almost equal strength immediately below it, forming double keel at outer base. Somewhat concave basal area with 1 or 2 spiral threads and 2 relatively smooth ribs surrounding open, funnel-shaped umbilicus. Coloration: yellowish to dark tan.

Animal: unknown.

REMARKS. — This form can be recognized by its pattern of three nodose spiral ribs on the exposed part of the teleoconch whorls, combined with an open umbilicus. The following species is similar.

Source : MNHN, Paris

Mathilda boucheti sp. nov.

Figs 4-6, 9

TYPE MATERIAL. — Holotype MNHN. Paratypes: 2 MNHN, 1 FMNH 224968, 1 NMP L1144/T1186, 1 USNM 887052.

TYPE LOCALITY. — New Caledonia, CHALCAL 2, stn DW 76, 23°41′ S, 167°45′ E, 470 m.

MATERIAL EXAMINED. — **New Caledonia**. CHALCAL 2: stn DW 76, 23°41′ S, 167°45′ E, 470 m, 1 dd (holotype).
BIOCAL: stn DW 38, 23°00′ S, 167°15′ E, 360 m, 1 dd (paratype MNHN). — Stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 2 dd (paratypes: 1 NMP, 1 USNM). — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 2 dd (paratypes: 1 MNHN, 1 FMNH).

DISTRIBUTION. — Not known from outside this study area; depth 360-610 m; no live material collected.

DESCRIPTION. — *Protoconch* (Fig. 4): smooth, globular, strongly hyperstrophic, at about 130° angle to teleoconch axis; embryonic whorl fully or largely exposed; consisting of about 2 1/2 whorls; PD 540-600 µm; with weak peritreme. Protoconch umbilicus completely covered by callus, extending between first TW and anal keel. Glassy or milk-white; embryonic whorl, protoconch suture and callus tan.

Teleoconch: slender cone-shaped; 4.3-5.7 mm at 5 to 6+ whorls; spire angle 31-32°. Pattern of regular spiral and weaker axial ribs, intersecting at almost right angles to form strong nodules. Spacing of the axials very regular, with ca. 17-21 on fourth whorl. Exposed upper part of whorls with 3 spiral ribs (middle one weakest, lowermost strongest); large specimens with weak additional thread below the middle rib, beginning at about 5 3/4 TW (see Fig. 9). Upper point of whorl attachment at a recessed, fifth spiral rib, partly covering it. On body whorl, this rib, and one of almost equal strength immediately below it, forming double keel at outer base. Basal area with 4-6 indistinct spiral threads. No open umbilicus; callous columella, relatively thick-shelled in larger specimens. Coloration: Early whorls white; after about 3 TW, spiral ribs, especially first and third, with tan color, darkest between nodes.

Animal: unknown.

Measurements:

	H	D	PD	TW	Locality	Collection
Holotype	5.0	2.6	600	5 7/8	[type loc.]	MNHN
Paratype 1	4.6	2.3	600	5 1/2	BIOCAL stn 46	FMNH 224968
Paratype 2	5.7	2.6	600	6 +	BIOCAL stn 46	MNHN
Paratype 3	4.3	2.4	580	5	BIOCAL stn 44	NMP L1144/T1186
Paratype 4	3.4	1.8	600	4 1/3	BIOCAL stn 44	USNM 887052
Paratype 5	2.3	1.3	540	3 1/2	BIOCAL stn 38	MNHN

REMARKS. — This species can be recognized by its pattern of three nodose spiral ribs on the exposed part of the teleoconch whorls, combined with distinct coloration. A similar form in the study area is *Mathilda brevicula* (see above), which differs by its open umbilicus and greater degree of heterostrophy. In the latter, the embryonic protoconch whorl is never exposed on the shell apex. A similarly three-ribbed form is *Mathilda retusa* Brugnone, 1873, described from the Mediterranean Sea (holotype HUJ 10.336, *vidi*). In that form, the second and third primary spiral ribs are of equal strength.

ETYMOLOGY. — Named for Dr Philippe BOUCHET, Muséum national d'Histoire naturelle, Paris, who made this material available for study.

Source : MNHN, Paris

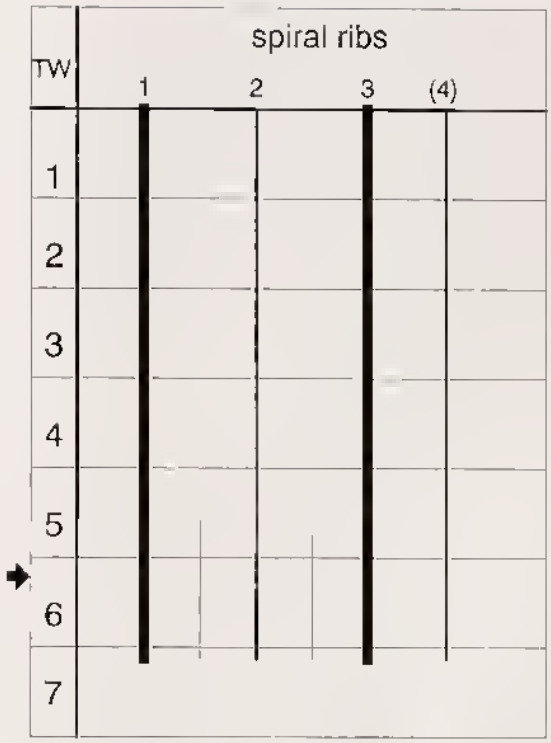


FIG. 8. — *Mathilda brevicula*. Diagram of spiral sculpture, showing relative position and strength of exposed spiral ribs on the upper side of teleoconch whorls (TW). Rib number in parentheses indicates primary spiral rib serving as attachment of subsequent whorl. Arrow indicating condition of holotype.

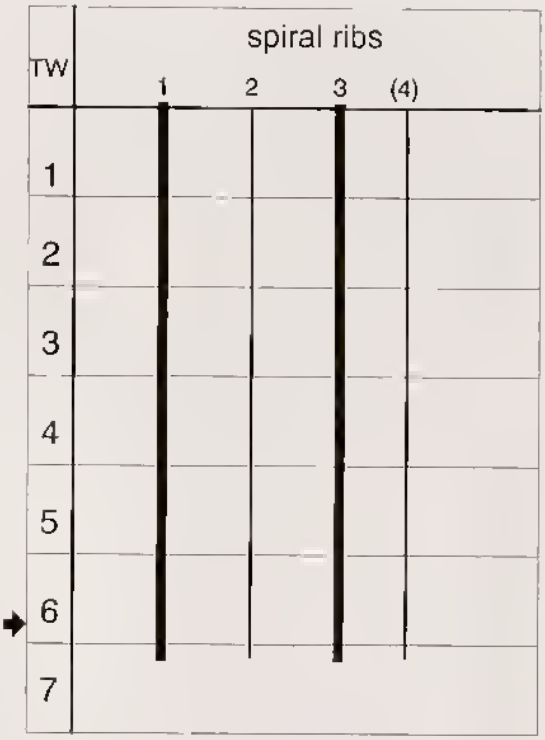


FIG. 9. — *Mathilda boucheti* sp. nov. Diagram of spiral sculpture, as in Fig. 8.

Mathilda cf. *amanda* Thiele, 1925

Figs 11, 14-16

? *Mathilda amanda* Thiele, 1925: 112 (78), pl. 20 (8), figs 26-27.

Synonym:

? *Eucharilda japonica* Kuroda & Habe *in* Kuroda, Habe & Oyama, 1971: 416 (Japanese), 260 (English), pl. 61, fig. 3 (unclear 19 mm color photograph, apparently of holotype).

TYPE MATERIAL. — *M. amanda*: lectotype (Fig. 10, here selected; H = 14.3, D = 4.1, protoconch missing; originally figured syntype) and 2 paralectotypes (fragments), ZMB unnumbered. — *E. japonica*: "Height 19.2 mm and breadth 5.8 mm (type specimen)" (KURODA & HABE *in* KURODA *et al.* 1971: 260); "HT, PT both in H. Majesty's Biol. Lab." (INABA & OYAMA 1977: 54).

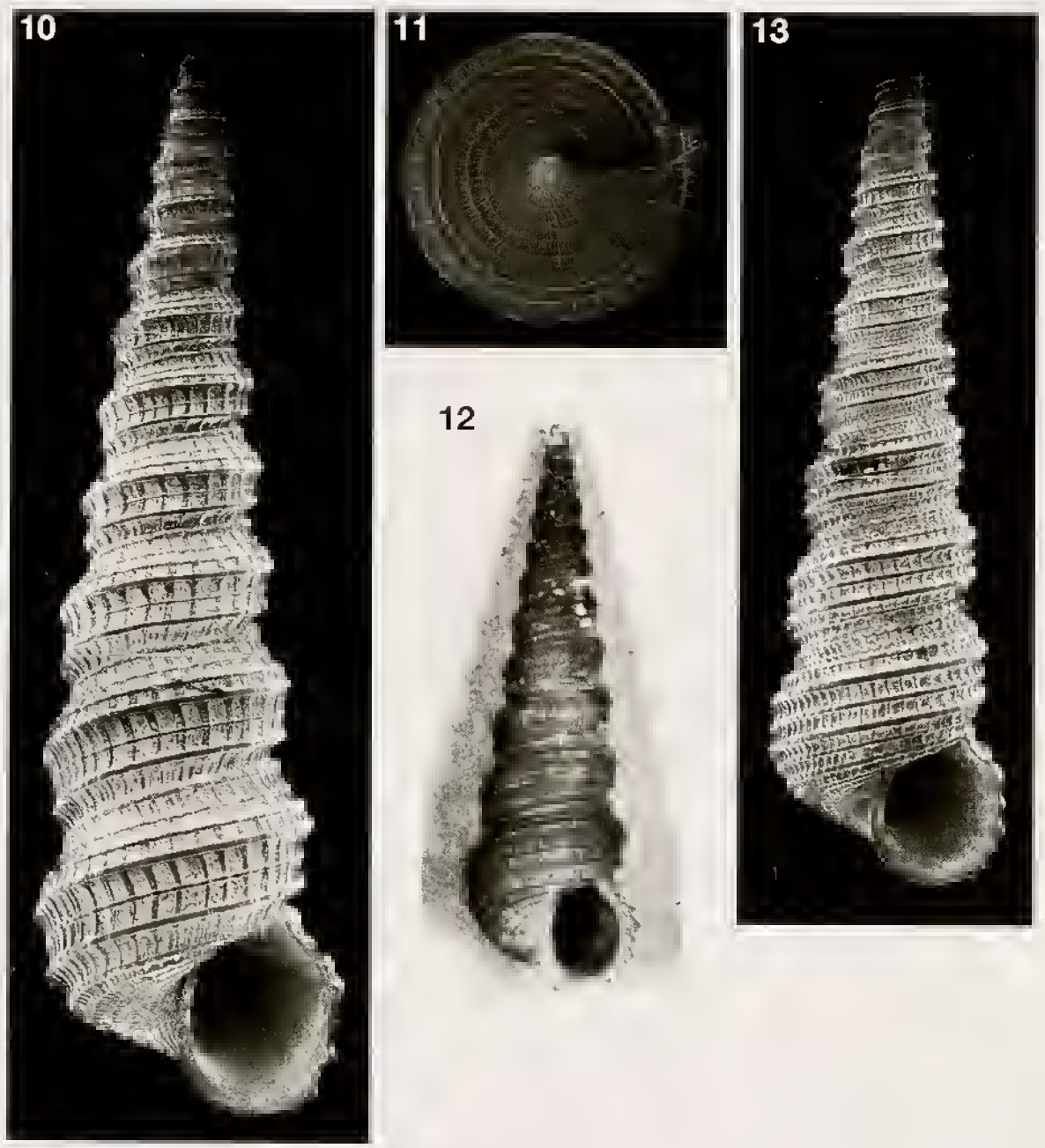
TYPE LOCALITY. — *M. amanda*: *"Valdivia"*, stn 244, East Africa, 5°55.8′ S, 39°1.2′ E, 50 m. — *E. japonica*: "Sagami Bay. Locality: Shuragane-Kakine, 20-35 m, (alive)".

MATERIAL EXAMINED. — Types of *M. amanda* and photograph of holotype of *E. japonica* (courtesy Prof. HABE; here reproduced in Fig. 12).

New Caledonia, LAGON: stn 220, 21°50′ S, 165°46′ E, 12 m, 1 dd. — Stn 797, 20°58′ S, 165°33′ E, 92 m, 1 dd. — Stn 836, 20°46′ S, 165°16′ E, 57 m, 1 dd.

P. Tirard coll., 22°40'-22°50′ S, 167°10'-167°30′ E, 200-350 m, 10.X.1986, 1 dd.

Source : MNHN, Paris



FIGS 10-13. — **10**, *Mathilda amanda*, lectotype ZMB, East Africa, 14.3 mm (SEM, uncoated). — **11**, *Mathilda* cf. *amanda*, shell base of specimen from New Caledonia, SMIB 5: stn DW81, diameter 3.1 mm. — **12**, holotype of *Eucharilda japonica*, Japan, 19.2 mm (light photograph courtesy Prof. Habe). — **13**, lectotype of *Mathilda carystia*, BMNH 1984201, Persian Gulf, 11.2 mm (SEM, uncoated).

Source : MNHN, Paris

SMIB 5: stn DW 81, 22°38′ S, 167°35′ E, 110 m, 3 dd [incl. SEM specimen]. — Stn DW 82, 22°32′ S, 167°32′ E, 155 m, 1 dd.

DISTRIBUTION. — Apparently widely ranging from Africa to Japan. New Caledonian depth records ranging from 12 to 350 m. No live-collected records aside from the type locality of nominal species *E. japonica* (20-35 m).

DESCRIPTION. — *Protoconch* (Figs 15-16): smooth; globular; strongly hyperstrophic, embryonic whorl largely exposed, at approximately 125° angle to teleoconch axis; consisting of 1.5 whorls; PD 460-520 µm; with weak peritreme. Protoconch umbilicus visible between first TW and strong anal keel (no callus observed in available specimens). Translucent orange-tan, with darker suture in some specimens.

Teleoconch: auger-shaped; 10.5 to 19+ mm at 11 to almost 14 whorls; spire angle ca. 17°, later to 21°. Pattern of regular spiral and weaker axial ribs, intersecting at almost right angles. Spacing of the axials very regular, with 23-29 on fourth whorl. Exposed upper part of whorls with 4 spiral ribs, with the 2 lower ones stronger and forming almost-smooth rings; ribs 2 and 3 closest together; third rib prominent and somewhat nodose on early whorls; larger specimens with weak additional threads interspaced (see Fig. 14). Upper point of whorl attachment at a fifth spiral rib, partly covering it. On body whorl, this rib, and one of almost equal strength immediately below it, forming double keel at outer base. Basal area with 4-6 weaker spiral ribs, often interspaced with finer threads; in some specimens with additional rib between primary spirals 3 and 4, reaching equal strength. Umbilicus narrow, almost or completely covered by columellar lip attachment. Coloration: overall horn- to orange-tan.

Animal: unknown.

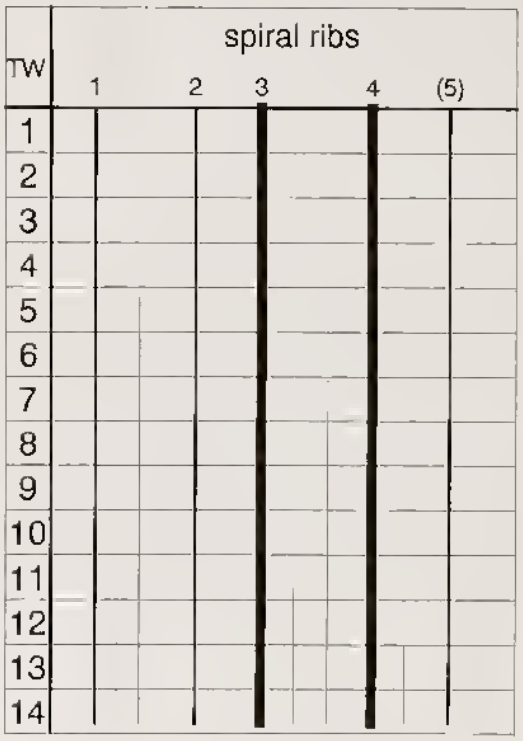


FIG. 14. — *Mathilda* cf. *amanda*. Diagram of spiral sculpture, as in Fig. 8.

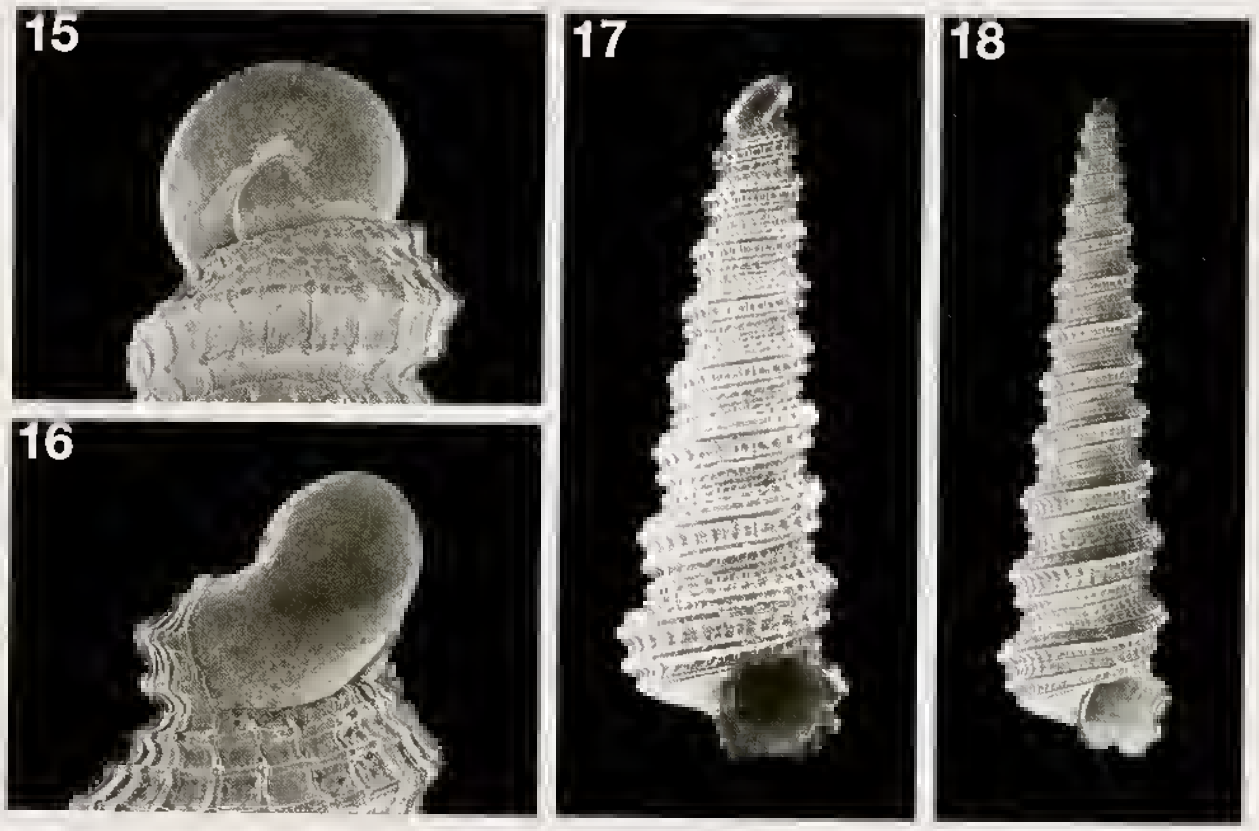
REMARKS. — This species is tentatively placed as *Mathilda* cf. *amanda* Thiele, 1925. The original specimens of THIELE's species all lack protoconchs; no additional specimens from that part of East Africa were available for comparison. The teleoconch characters, including whorl expansion and spire angle, closely match the *amanda* lectotype (Fig. 10) with material from New Caledonia.

The holotype of *Eucharilda japonica* shows very similar teleoconch sculpture and likewise a spire angle of ca. 20°. Judging from original description and available photograph (Fig. 12), that nominal species may be synonymous.

Based on the present material from New Caledonia, the protoconch size range of "cf. *amanda*" is 460-520 µm. This appears to be the only character separating this form from *Mathilda carystia* Melvill & Standen, 1903 of the Persian Gulf and Gulf of Oman (Fig. 13). Protoconchs of that nominal species also have only 1.5 whorls, but are considerably smaller (360-400 µm). The discovery of additional material may show the two morphs to be conspecific.

Taxonomic note on *Mathilda carystia*: *Mathilda carystia* was described by MELVILL & STANDEN (1903: 321-322) from an unstated number of specimens. The given range of color variation ("pale chestnut, dark chestnut, brown, or blackish") indicates numerous syntypes. The origin of the material was given as "Persian Gulf, Koweit, 10 fathoms, mud and sand". The species remained unfigured until the following year, when MELVILL (1904: pl. 8, fig. 7) illustrated a specimen from a different locality in the Gulf of Oman. This specimen (BMNH 1905.6.12.6) was mentioned as "figured syntype" by TREW (1987: 30), but does not qualify as part of the original type series. Of the seven syntypes in BMNH lot 1984201, the largest (H = 11.2, D = 3.2) is closest to the dimensions given in

Source : MNHN, Paris



FIGS 15-18. — **15-16**. *Mathilda* cf. *amanda*, specimen from New Caledonia, (same as in Fig. 11), SMIB 5; stn DW 81, aspects of protoconch and first teleoconch whorl, protoconch diameter 460 µm. — **17-18**, *Mathilda sinensis* (SEM, uncoated). — **17**, lectotype of *Mathilda sinensis*, MNHN, China Sea, 5.8 mm. — **18**, lectotype of *Mathilda telamonia*, BMNH 1912.9.17.26, Persian Gulf, 12.4 mm.

the original description ("long. 12, lat. 3 mm"), and is here selected as lectotype of *Mathilda carystia* (Fig. 13). Two additional paralectotypes are in Cardiff (NMW 1955.158.192, *vidi*).

A species very similar to the *amanda-carystia* complex is *Mathilda sinensis* Fischer, 1867, from the China Sea (1867: 304, pl. 9 [erroneously referred to in text as "XI"], fig. 3). FISCHER did not indicate a holotype in his description and the originally figured syntype is here selected as lectotype (MNHN, Fig. 17). The lectotype (H = 5.8, D = 1.8, TW = 8 1/2+) shows the same general pattern of four major spiral ribs as does *M.* cf. *amanda* from New Caledonia, but differs in having more than 1.5 protoconch whorls as well as a more slender spire angle (16°). *Mathilda telamonia* Melvill, 1912, from the Persian Gulf is here synonymized with *M. sinensis*. MELVILL's original description (1912: 246, pl. 12, fig. 12) did not indicate the number of specimens in the type series, nor did he designate a holotype. TREW's (1987: 66) mention of a holotype (BMNH 1912.9.17.26) is here accepted as a lectotype designation in accordance with ICZN Article 74(b). The lectotype (H = 12.4, D = 3.1, PD = 520 µm; Fig. 18) matches the type dimensions of *M. sinensis* perfectly in having 8 1/2 teleconch whorls at a height of 5.8 mm.

The *Mathilda amanda*-complex shares the pattern of two pairs of primary spiral ribs on the exposed part of the whorls ("2+**2**" pattern) with several species. These include *Mathilda decorata*, an unnamed *Mathilda* species (discussed below), as well as four Japanese forms described in a separate section below. *Mathilda salve* (also discussed below) shows the "2+**2**" pattern on its later whorls.

Source : MNHN, Paris

Mathilda decorata Hedley, 1903

Figs 19-24, 26, 27

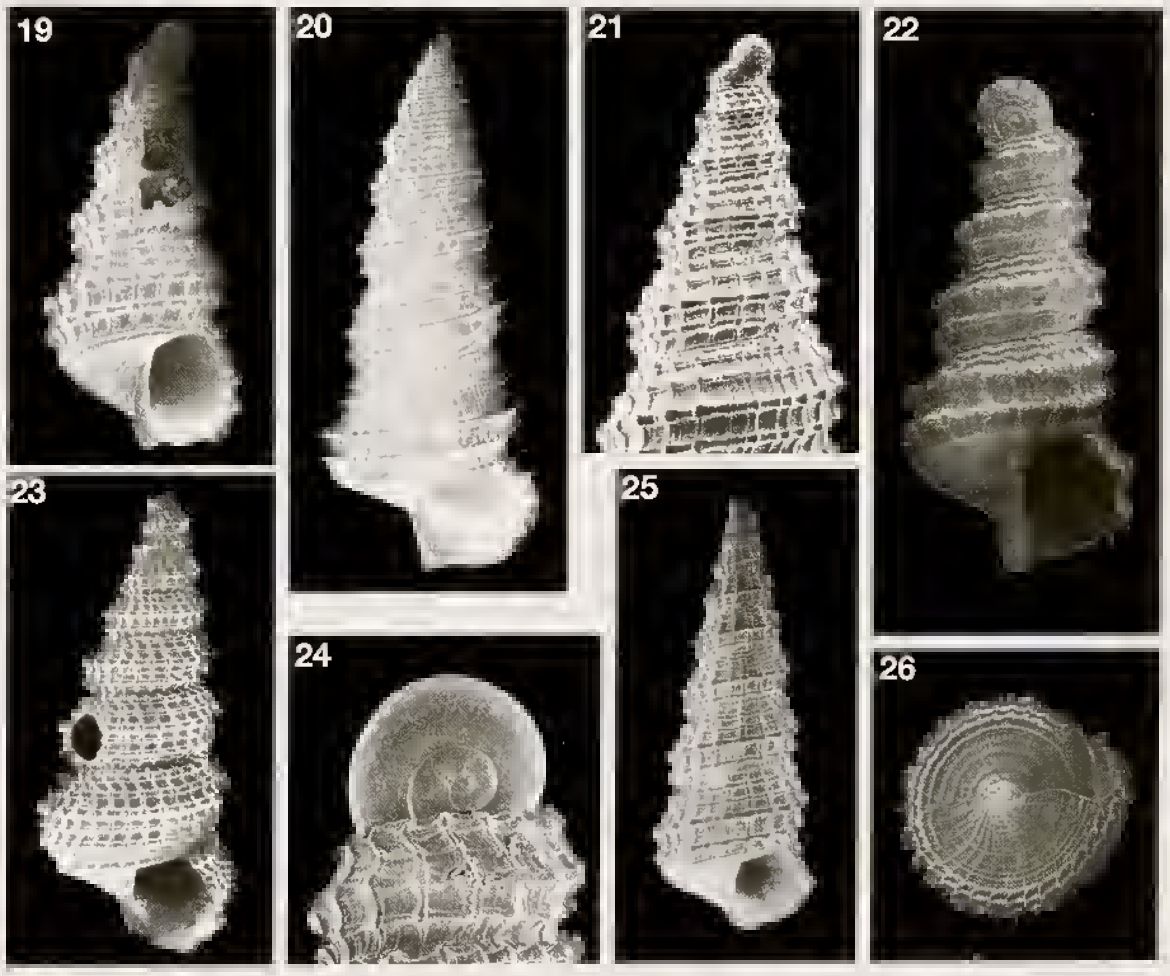
Mathilda decorata Hedley, 1903: 352, fig. 75 (holotype).

Synonyms:

Mathildona euglypta Iredale, 1929: 186, pl. 40, fig. 6 (sketch of holotype).
Opimilda decorata auporia Dell, 1956: 39-40, fig. 27 (holotype).

Other references:

Mathilda decorata – Hedley & Petterd, 1905: 214. — Hedley, 1918: M97. — May, 1921: 98; 1923: 93, pl. 44, fig. 8. — Thiele, 1925: 82, fig. 85 (after Hedley, 1903). — Bieler, 1988: 215, figs 10-11 (SEM of radula, AMS C14868).
Opimilda decorata – Thiele, 1931: 737. — Cotton & Godfrey, 1938: 13. — Macpherson & Gabriel, 1962: 99. — Laseron, 1951: 331, fig. 80.
Mathilda (Opimilda) decorata – Wenz, 1939: 662, fig. 1888 (after Hedley, 1903).
Mathildona euglypta – Thiele, 1931: 737.
Mathilda (Mathildona) euglypta – Wenz, 1939: 662, fig. 1887 (after Iredale, 1929).
Glyptozarin euglypta – Laseron, 1951: 333, fig. 85. — Macpherson & Gabriel, 1962: 99.
Opimilda decorata auporia – Powell, 1976: 107; 1979: 250. — Maxwell, 1966: 446.



Figs 19-26. — **19-24**, *Mathilda decorata*. **19**, holotype AMS C16299, New South Wales, 4.25 mm (SEM, uncoated); specimen slightly tilted. — **20**, holotype of *Mathildona euglypta*, AMS C57720, New South Wales, 18.5 mm (SEM uncoated). — **21**, apex of holotype of *M. euglypta*, enlarged to same scale as Fig. 19 (SEM, uncoated). — **22**, holotype of *Opimilda decorata auporia*, NMNZ M8205, New Zealand, 3.4 mm (SEM, uncoated). — **23-24**, specimen from New Caledonia, BIOCAL: stn 77, shell length 9.2 mm, protoconch diameter 620 µm. — **25**, *Mathilda zuiltampis*, lectotype BMNH 1901.12.9.144, Gulf of Oman, 10.4 mm (SEM, uncoated). – **26**, *Mathilda decorata*, same specimen as in Fig. 24, shell base, diameter 3.7 mm.

Source : MNHN, Paris

TYPE MATERIAL. — *M. decorata*: holotype AMS C16299: H = 4.25, D = 2.0, PD = 580, TW = 4 1/2+; with shell damage in second and third teleoconch whorls. — *M. euglypta*: holotype AMS C57720: H = 18.5, D = 6.6, PD = 560, TW = 9 3/4. — *O. decorata auporia*: holotype NMNZ M8205: H = 3.4, D = 1.6, PD = 0.56, TW = 4 1/4; with large drill hole at beginning of third whorl.

TYPE LOCALITY. — *M. decorata*: "in 63 to 75 fathoms off Port Kembla" (trawled 5-8 miles off Port Kembla, New South Wales [Australia], 113-115 m, mud and pebbles, *"Tethis"*, stn 49, 18.III.1898, E.R. White coll.; *teste* type label). — *M. euglypta*: "Trawled in 50-60 fathoms off Montague Island, New South Wales [Australia]". — *O. decorata auporia*: "Five miles east of North Cape in 75 fathoms ... New Zealand".

MATERIAL EXAMINED. — Types as listed above and additional specimens from New Zealand (NMNZ) and Australia (AMS).

New Caledonia. *"Vauban"* 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 1 dd.

BIOCAL: stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 1 dd. — Stn DW 77, 22°15′ S, 167°15′ E, 440 m, 1 dd [SEM specimen].

MUSORSTOM 4: stn DW 159, 18°46′ S, 163°16′ E, 585 m, 1 dd.

MUSORSTOM 5: stn 388, 20°45′ S, 160°54′ E, 500-510 m, 1 dd.

Loyalty Islands. BIOGEOCAL: stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 1 dd. — Stn DW 308, 20°40′ S, 166°58′ E, 510-590 m, 1 lv.

MUSORSTOM 6: stn DW 406, 20°41′ S, 167°07′ E, 373 m, 1 dd.

CALSUB: dive 15, 20°37′ S, 166°58′ E, 538 m, 1 dd.

DISTRIBUTION. — Apparently widely distributed in at least the southwestern Pacific Ocean. Depth records from the New Caledonian region ranging from 250 to 610 m (live record from 510-590 m); published Australian and New Zealand records from 90 m and deeper.

DESCRIPTION. — *Protoconch* (Fig. 24): smooth, globular, hyperstrophic, approximately 100-105° to first teleoconch whorl; embryonic whorl fully exposed; protoconch consisting of 2 1/2 whorls; 560-640 µm in maximum diameter; with weak, hardly elevated peritreme. Weak, curved anal keel bordering deep umbilicus; protoconch umbilicus completely covered by thin, reddish-brown lamella extending between first TW and anal keel. Glassy white to light horn-colored; embryonic whorls, area before peritreme, callus and anal keel brown.

Teleoconch (Fig. 23): slender, tapering (spire angle 25-29°), relatively thin-shelled, with rounded whorls and distinct suture; height 3.4 to 12.1 mm at 4 1/4 to 8 3/4 whorls. Pattern of spiral and axial ribs (with axials often as prominent as spirals), intersecting at approximately right angles to form nodules. Spacing of the axials regular (with 18-25 on fourth whorl), resulting in pattern of almost equal-sided squares on periphery; these "windows" without sculpture except faint growth lines. Spiral sculpture on exposed upper part of earlier whorls consisting of 2 pairs of ribs, with lowermost pair stronger; the second rib initially weakest, the third rib strongest and occasionally somewhat more prominent. After 4 1/2 to 7 1/2 whorls (highly variable) with fine additional spiral threads interspaced (see Fig. 27). Upper point of whorl

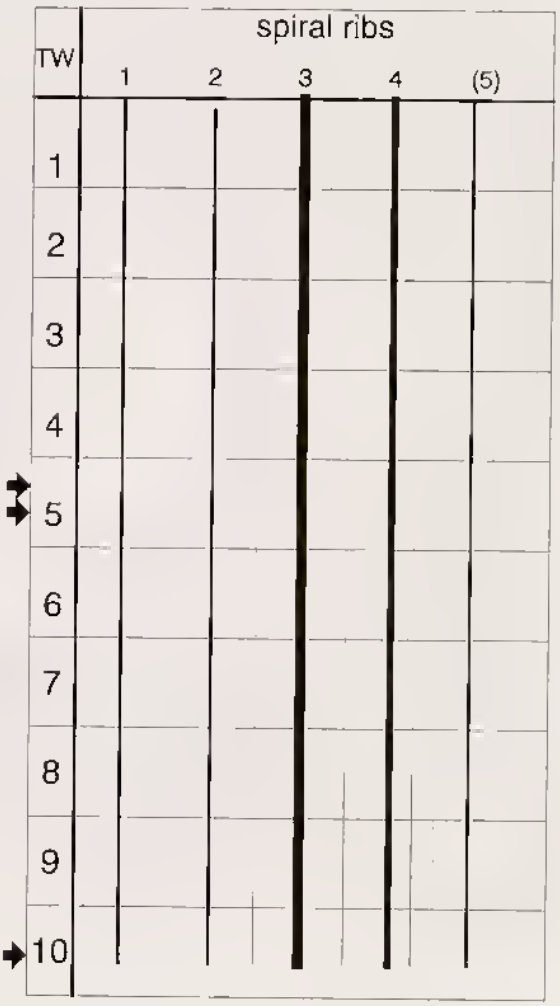


FIG. 27. — *Mathilda decorata*. Diagram of spiral sculpture, as in Fig. 8. Arrows indicating, top to bottom, conditions of holotypes of *Opimilda auporia*, *Mathilda decorata*, and *M. euglypta*, respectively.

Source : MNHN, Paris

attachment at a recessed, fifth spiral rib, fully or partly covering it. On body whorl, this rib, and one of almost equal strength below it, forming relatively smooth double keel at outer base. Straight, or somewhat rounded basal area (Fig. 26) with 4-9 more-or-less faint spiral threads (increasing in strength toward columella) and weak axial threads. Umbilicus a narrow chink or closed by reflected columellar lip. Coloration: translucent white. Periostracum thin, yellowish-white, forming round hollow scales on shell nodules.

Animal: radula taenioglossate-like with five teeth per row (interpreted as rachidian, one pair of laterals and one pair of marginals; see BIELER 1988: 214, figs 10-11); rachidian and laterals separated by wide space; rachidian with ca. 24 long, filiform cusps of subequal strength, the central ones being longer; marginal teeth longer and with more denticles than the laterals; marginals with feather-like extensions projecting at an oblique angle from shortly below the tip of the "normal" tooth.

REMARKS. — This species is readily recognized by its relatively large protoconch set at about 100° angle, the two unequal pairs of spiral ribs on the whorl surface ("2+2" pattern), and the rounded whorls separated by a distinct suture. The New Caledonian material agrees well with the studied type material from Australia and New Zealand. Other forms with "2+2" morphology are *Mathilda* cf. *amanda* (discussed above), an unnamed species (*Mathilda* sp. A, below), as well as four Japanese forms described in a separate section below.

The difference cited by DELL (1956: 39) between *Mathilda decorata* and his nominal subspecies *auporia* (Fig. 22) was given as "... mainly in the number of axials. In *decorata decorata* there are some 25 axials; in the new form there are 19 on the body whorl". This character varies widely (18-25) in the New Caledonia material, and the two nominal taxa are here synonymized.

Mathildona euglypta (Figs 20-21) is the type species of *Mathildona* Iredale, 1929 (:186). On the following page, IREDALE (1929: 187) introduced another nominal genus: "*Opimilda* is added for *decorata* Hedley, a short, squat, perforate shell, quite dissimilar". WENZ (1939: 662) reproduced the two original illustrations side by side without indicating a scale, and, thus misled described differences between *Mathildona* and *Opimilda* (*e.g.*, referring to relatively small and relatively large protoconchs, respectively). The two nominal type species were based on different growth stages of the same species; the holotype of *M. decorata* is a subadult shell, while the type of *M. euglypta* represents a fully grown specimen (compare Figs 19-21). Accordingly, the nominal genera *Opimilda* and *Mathildona* are also synonymous. LASERON (1951: 332-333) erroneously synonymized *Mathildona* under *Glyptozaria* (a member of Cerithiidae, see below).

Mathilda zmitampis Melvill & Standen, 1901 (: 379, pl. 22, fig. 19; type locality: "Gulf of Oman: lat. 24° 5′ N., long. 37° 35′ E, 208 fathoms [380 m], sand") is similar. In that species, the third primary spiral rib is initially stronger, the teleoconch whorls are less rounded, the suture not as deep as in *M. decorata*, and the protoconch is smaller (Fig. 25; lectotype, BMNH 1901.12.9.144: H= 10.4, D= 3.7, PD= 0.5, TW= 8 1/4+).

Taxonomic note on *Mathilda zmitampis*: MELVILL & STANDEN's original description (1901: 379) did not indicate the number of specimens in the type series, nor was a holotype indicated. TREW's (1987: 72) mention of a holotype (BMNH 1901.12.9.144) is here accepted as a lectotype designation in accordance with ICZN Article 74(b). This lectotype is the originally figured specimen. The original description mentioned a 208 fathoms station in the Gulf of Oman as the source for the type material. Material labelled "co-types" of *M. zmitampis* can be found in various museum collections (*e.g.*, NMW, ANSP); most such lots are mixtures of various mathildid and non-mathildid species. Since all such material encountered stems from another location (156 fathoms station, cited for *M. zmitampis* only in a subsequent publication by MELVILL & STANDEN [1903: 322]), it does not qualify as type material.

Atlantic *Mathilda barbadensis* Dall, 1889 (: 266, pl. 26, fig. 10; holotype USNM 87328, *vidi*; not figured here) also appears to belong to this complex. The protoconch diameter in that species is much smaller, measuring only 440 µm in the type specimen.

Source : MNHN, Paris

Mathilda maoria (Powell, 1940)

Figs 28-29, 32-33, 38

Opimilda maoria Powell, 1940: 230-231, pl. 29, fig. 7 (sketch of holotype).

Other references:

Opimilda maoria – Maxwell, 1966: 446. — Powell, 1976: 107, pl. 27, fig. 7 (sketch of holotype); 1979: 250, pl. 48, fig. 24 (sketch of holotype). Haszprunar, 1985: 201 ff., figs 2, 4, 7-11 (anatomy), 5-6 (shells).

Type material. — Holotype AIM AK72108: H= 3.1, D= 2.0, PD= 600, TW= 3 9/10 (specimen was larger); paratype AK72311 (from type locality): H= 3.0, D= 1.8 (damaged, specimen was larger), PD= 580, TW= 3 1/4.

Type locality. — "Locality: 140 fathoms off Three Kings Islands, New Zealand" [ca. 34° S, 172° E, depth 256 m].

Material examined. — Type material as listed above, and additional specimens from New Zealand (*e.g.*, NMNZ M60793).

New Caledonia. BIOCAL: stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 1 dd [SEM specimen]. — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 2 dd.

CHALCAL 2: stn DW 72, 24°55′ S, 168°22′ E, 527 m, 1 lv.

Distribution. — Here verified from New Zealand and New Caledonia, but presumed widely distributed in the Indo-Pacific (probably conspecific juvenile specimen from Gulf of Oman [NMW] awaiting further study). New Caledonian depth records from 527 to 700 m (live from 527 m); New Zealand records from shallower depths.

Description. — *Protoconch* (Figs 32-33): smooth, globular, strongly hyperstrophic, at about 125° angle to teleoconch axis; with approximately one third of the embryonic whorl exposed; ca. 2 1/2 whorls; PD 580-640 µm; peritreme weak; protoconch umbilicus covered by thin reflected lamella extending between first TW and anal keel. Glassy white, with lamella, area before peritreme, anal keel, and suture reddish-brown.

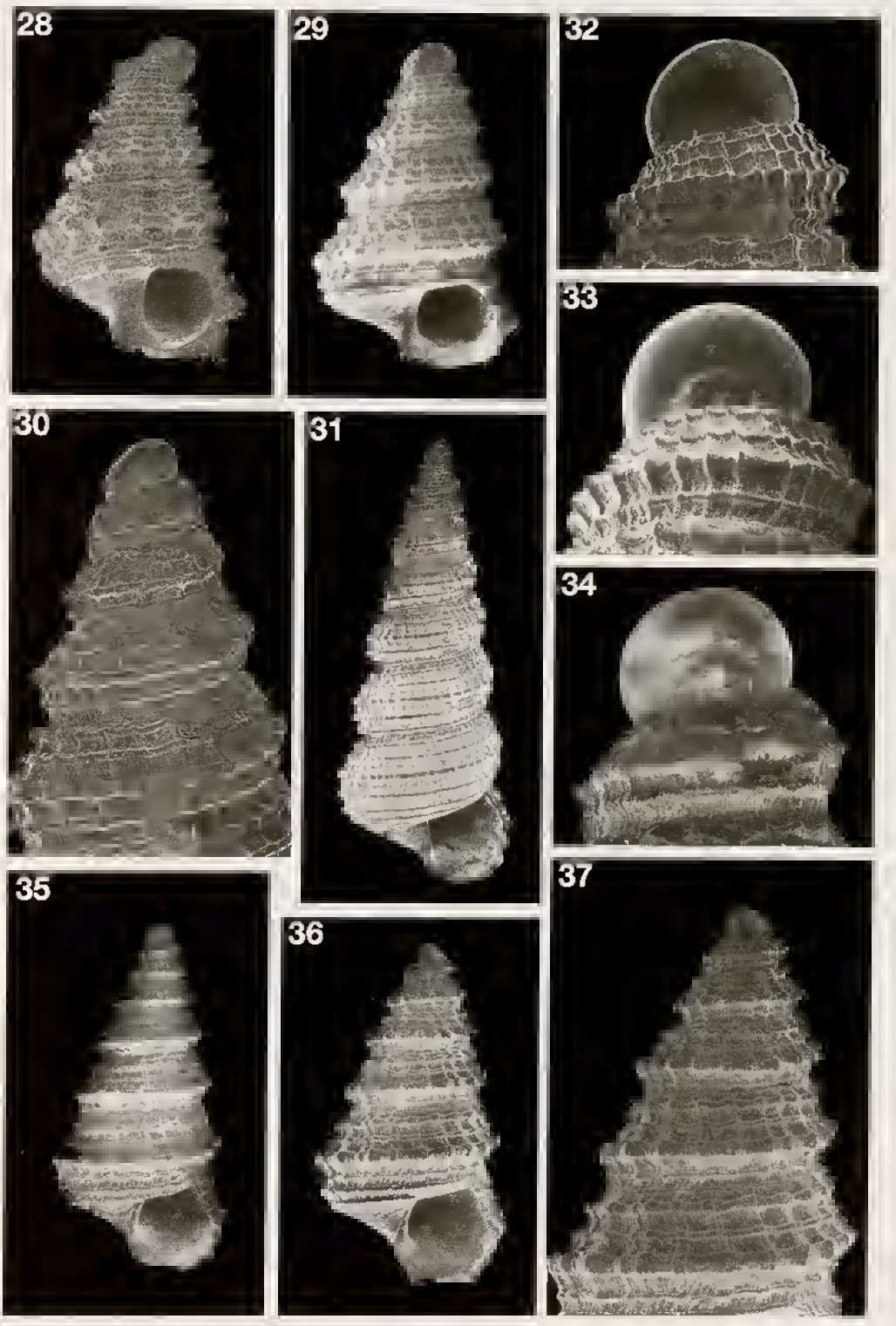
Teleoconch (Figs 28-29): cone-shaped; relatively thin (empty shells translucent in "windows" between strong ribs); larger specimens 6.9 to 13.1 mm at 6 to 8 1/10 whorls; spire angle ca. 38°. Primary pattern on upper side of whorls of 4 spiral and numerous axial ribs, intersecting at approximately right angles to form nodules, spirals stronger; the third clearly strongest and most prominent. Spacing of axials regular (with 17-25 on fourth whorl). After about 5-6 whorls with additional spiral threads interspersed (Fig. 38). Whorl attachment on a fifth primary spiral rib and one of almost equal strength below (or directly fused with it) demarcating basal perimeter. Basal area with 4-6 weak, more-or-less irregular spiral ribs, interseeted by irregular axial growth lines; umbilicus not open. Columellar lip thin, not or only slightly reflected over columella. Coloration: live-collected shell slightly mottled horn-colored with tips of nodules lighter; dead-collected shells overall milk-white. Straw-colored, scaly periostracum covering shell.

Animal: awaiting study; horny operculum flat, concentric and multispiral.

Remarks. — *Mathilda maoria* was described by Powell (1940) on the basis of two juvenile specimens with fewer than 4 teleoconch whorls each. Both specimens had been larger; the remnants of subsequent whorls obscure the sculptural features of the base in the types. Several specimens in the New Caledonian region appear conspecific, the only difference being the larger number (up to 25) of axial ribs on the fourth teleoconch whorl, compared to 17 in the holotype.

The pattern of exposed primary spiral ribs in this form is "2+1+1", with the third rib strongest. This pattern is shared with a few other species in New Caledonia (all discussed below): *Mathilda* cf. *hendersoni*, *Mathilda richeri* sp. nov. (with additional ribs), and *Mathilda* sp. aff. *sausibarica* (with ribs fading on later whorls). The relationship of this form with nominal species *Mathilda salve* Barnard, 1963, originally described from South Africa, needs further study. See following discussion.

Source : MNHN, Paris



FIGS. 28-37. — **28, 32**, *Mathilda maoria*, holotype of *Opimtaa maoria*, AIM AK72108, New Zealand, shell length 3.1 mm, protoconch diameter 600 µm (SEM, uncoated). — **29, 33**, *Mathilda maoria*, specimen from New Caledonia, BIOCAL: stn DW 46, shell length 4.3 mm, protoconch diameter 620 µm. — **30, 31, 34**, *Mathilda salve*, holotype SAM A9139, South Africa, shell length 15.4 mm, protoconch diameter 560 µm (SEM, uncoated). — **35**, *Mathilda salve*, specimen from New Caledonia, BIOCAL: stn CP 75, 7.8 mm. — **36-37**, *Mathilda* cf. *quinquelirata*, specimen from New Caledonia, BIOCAL: stn DW 33, 5.4 mm.

Source : MNHN, Paris

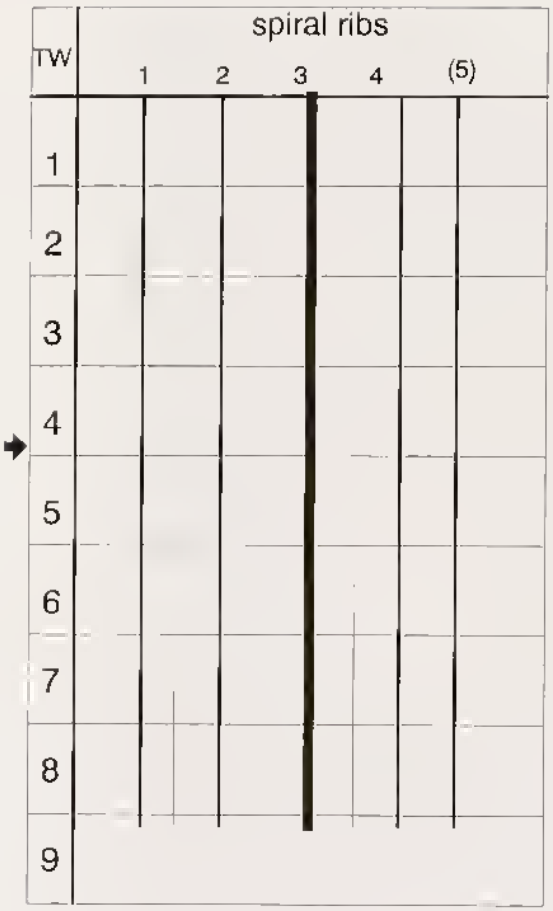


FIG. 38. — *Mathilda maoria*. Diagram of spiral sculpture, as in Fig. 8.

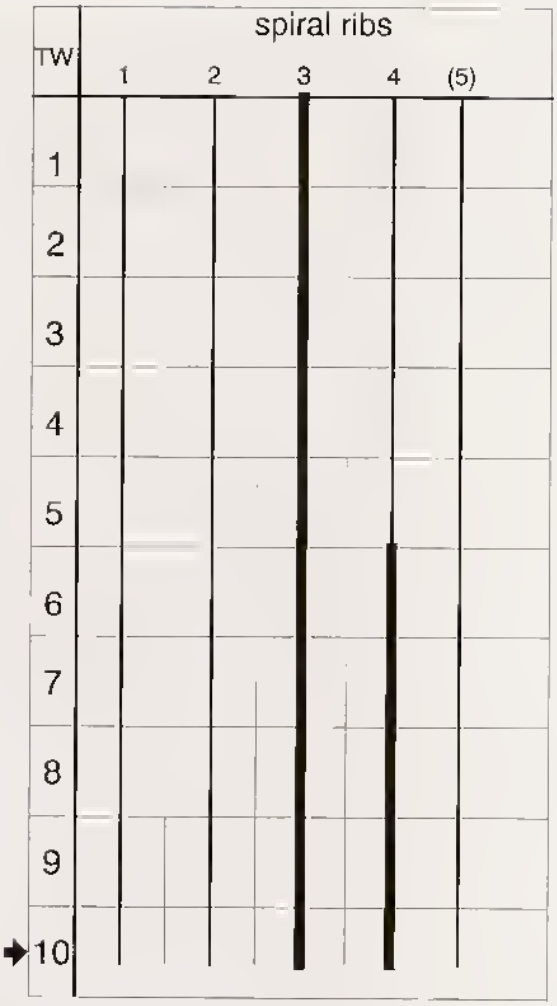


FIG. 39. — *Mathilda salve*. Diagram of spiral sculpture, as in Fig. 8. Fifth rib exposed in holotype.

Mathilda salve Barnard, 1963

Figs 30-31, 34-35, 39

Mathilda salve Barnard, 1963: 176-177, fig. 34.

Other references:

Mathilda salve — KENSLEY, 1973: 74, fig. 239. — BARNARD, 1974: 712.

TYPE MATERIAL. - - Holotype SAM A9139: H = 15.4, D = 5.7, PD = 560, TW = 9 1/2; paratype SAM A9141: H = 6.5, D = 2.6 (fragment of 7 whorls, without protoconch). The original description mentions a second paratype ("apex of 4 whorls, no protoconch") which currently cannot be located (SAM A9410; E. HOENSEN, *in litt.* 1993).

TYPE LOCALITY. — "Cape St. Blaize N. × E. 73 miles. 125 fathoms" [228 m, South Africa]; collected by Cape Government trawler *Pieter Faure* (1897-1907). Paratype SAM A9141 from "off Glendower Beacon (Port Alfred), 100 fathoms" [183 m]; paratype SAM A9140 from "Cape Morgan N. 1/2 W. 77 fathoms" [141 m].

Source : MNHN, Paris

MATERIAL EXAMINED. Holotype and paratype SAM A9141 as listed above, and additional material from South Africa (NMP).

New Caledonia. BIOCAL: stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 1 dd. — Stn CP 75, 22°19′ S, 167°23′ E, 825-860 m, 1 dd [SEM specimen].

CHALCAL 2: stn DW 74, 24°40′ S, 168°38′ E, 650 m, 1 dd.

DISTRIBUTION. Apparently widely distributed in at least the southern parts of the Indo-Pacific, previously known only from South Africa. New Caledonian material from 650-860 m. South African records shallower (from 140 m): no live records.

DESCRIPTION. — *Protoconch* (Fig. 34): smooth, globular, strongly hyperstrophic, about 120° to teleoconch axis; with embryonic whorl exposed; with approximately 2 1/2 whorls; PD 560-620 µm; peritreme weak; protoconch umbilicus covered by thin lamella extending between first TW and anal keel. Glassy white, with lamella, area before peritreme, anal keel, and suture reddish-brown.

Teleoconch (Figs 30-31, 35): slender cone-shaped with rounded periphery of later whorls; relatively thin and translucent in "windows" between strong ribs; larger specimens 8-15.4 mm at 6+ to 9 1/2 whorls; spire angle on early whorls about 35°, later changing to ca. 22°. Primary pattern on upper side of whorls of 4 exposed spiral (Fig. 39) and numerous axial ribs, intersecting at approximately right angles to form nodules (with 18-21 on fourth whorl); the third primary spiral strongest and most prominent, the fourth almost as strong and prominent on later whorls. After 4-6 whorls with additional threads interspersed. Whorl attachment on a fifth primary spiral rib (this rib often partly exposed), demarcating basal perimeter; additional rib of about equal strength next to it, but separated by distinct space. Basal area with about 7-9 irregular spiral ribs and threads, intersected by irregular axial growth lines; umbilicus not open. Coloration: dead-collected shells overall milk-white, occasionally with some tan on spiral ribs.

Animal: unknown.

REMARKS. — The holotype of *Mathilda salve* (Figs 30-31, 34) appears to be a slightly aberrant specimen in that it shows shell repairs in the second and fourth teleoconch whorls. The second repair caused the upper point of shell attachment to be no longer on the fifth primary spiral rib, but below it (thus exposing this rib). The available paratype specimen (SAM A9141) is more slender than the holotype, and its partially preserved whorls show a regular 4-ribbed pattern, with the third rib initially stronger; it may not be conspecific. KENSLEY's (1973: 74, fig. 239) sketch of this species appears highly stylized and does not accurately depict spiral rib pattern. The protoconchs of New Caledonia material are somewhat larger (580-620 µm) than that of the holotype (560 µm). The holotype also has slightly more axial ribs (21) on the fourth teleoconch whorl than the studied New Caledonian specimens (18-19).

This nominal species is very similar to *Mathilda maoria* (see above) in most characters. Distinguishing features appear to be details of the spiral sculpture (*salve*: third and fourth primary spiral ribs of near-equal strength on later whorls, fifth rib more-or-less exposed; *maoria*: third rib remains strongest, fifth rib largely covered by whorl attachment), the angle of the protoconch (*salve*: embryonic whorl almost completely exposed; *maoria*: about 1/3 of embryonic whorl exposed). Also, the teleoconch spire angles and whorl expansion rates differ slightly. The two forms are microsympatric at BIOCAL: stn DW 51, 23°05′ S, 167°45′ E, 680-700 m. Pending anatomical studies and a comparison of additional material from New Zealand and South Africa, they are here treated as separate species. The ontogenetic change from a "2+**1**+1" pattern of exposed primary sculpture to a "2+**2**" pattern (Fig. 39) cause larger specimens to resemble the condition in *Mathilda decorata* (discussed above).

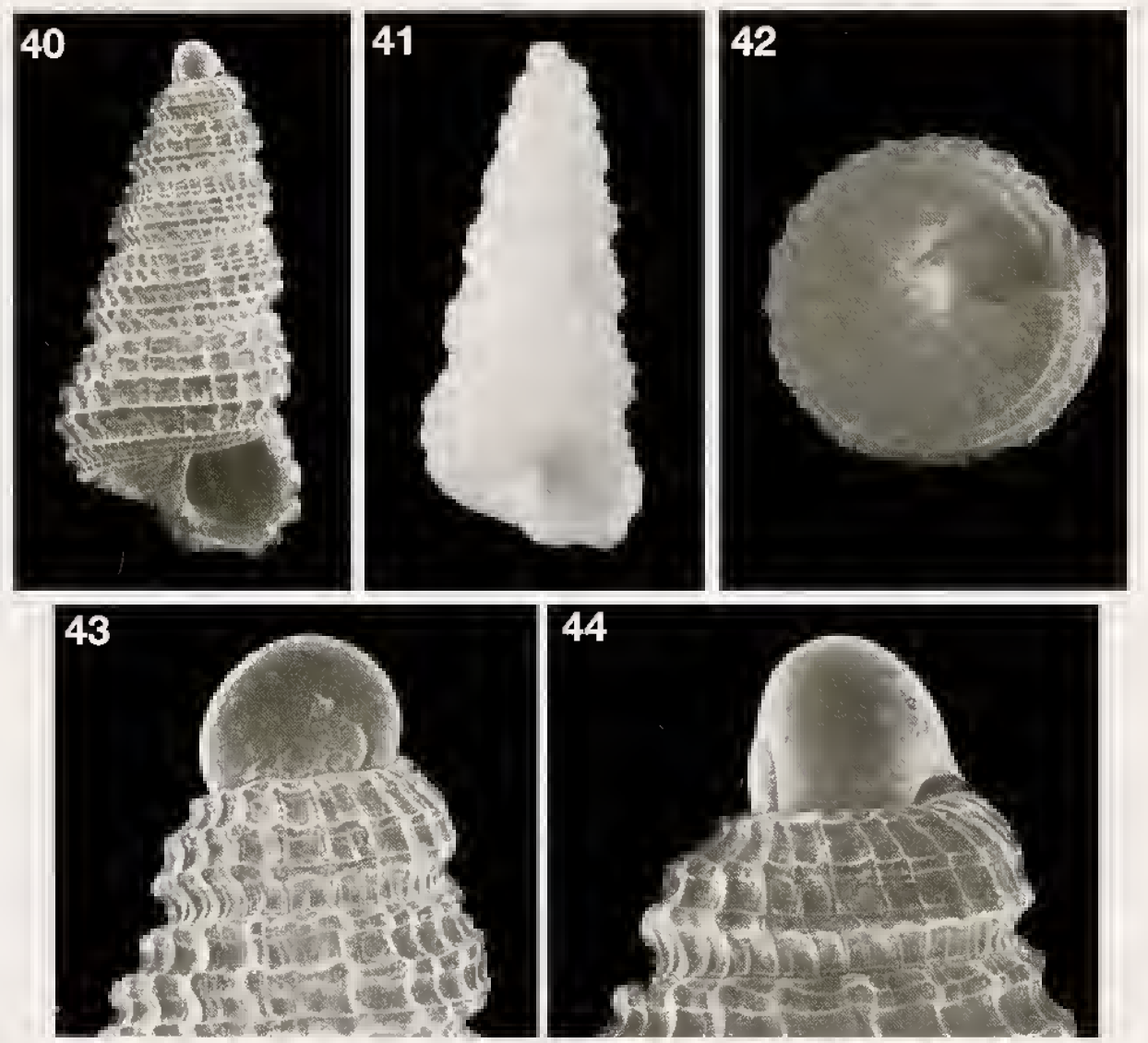
Nineteen additional specimens in the New Caledonia material (mostly juveniles between 1.2 and 3 mm in length) could not be reliably assigned to either nominal species (LAGON: stn DW 830; BIOCAL: stn DW 08, DW 38, DW 44; MUSORSTOM 4: stn DW 156; MUSORSTOM 6: stn DW 399, DW 459, DW 484).

Another nominal species very similar to the *maoria/salve* complex is *Mathilda quinquelirata*[1] Kuroda, 1958 (: 25, pl. 21, fig. 12; Figs 36-37), described from Japan. The type material (which was placed in a private Japanese collection after KURODA's death), consists of a holotype and several

1. This species was also distributed to various collections under the manuscript names "*quinquaeplicata*" and "*quinquescalpta*", and has been listed as "*Opanilda quiquelirata*" in the literature (*e.g.*, HIGO, 1973: 227).

Source : MNHN, Paris

paratypes. The holotype was live-collected (the operculum is mentioned in the original description), but no type specimen had a protoconch preserved (KURODA, 1958: 26). Topotypic specimens that appear to represent this species (*e.g.*, ANSP 189901, 248266; DMNH 23518) likewise lack protoconchs. The main difference in teleoconch sculpture between this form and the *maoria/salve* complex is that the second primary spiral rib is as weak as the fourth, resulting in a somewhat concave area between the well-developed first and very strong third rib, similar to the condition in *M.* sp. aff. *sansibarica* (see below). A single specimen in the New Caledonia material (BIOCAL: stn DW 33, 23°10′ S, 167°10′ E, 675-680 m) shows these characters (H = 5.5, D = 3.0, PD = 580, TW = 5 3/8; Figs 36-37).



FIGS. 40-44. — *Mathilda maculosa* sp. nov. — **40**, paratype FMNH 224969, New Caledonia, 3.7 mm. — **41**, holotype, Loyalty Islands, 4.4 mm (light photograph, showing color pattern of tan blotches). — **42**, shell base of paratype, diameter 1.8 mm. — **43-44**, aspects of protoconch and early teleoconch whorls, paratype, protoconch diameter 500 µm.

Source : MNHN, Paris

Mathilda maculosa sp. nov.

Figs 40-45

TYPE MATERIAL. — Holotype MNHN. Paratype FMNH 224969.

TYPE LOCALITY. — Loyalty Islands. MUSORSTOM 6, stn DW 442, 20°54′ S, 167°17′ E, 200 m.

MATERIAL EXAMINED. — **Loyalty Islands**. MUSORSTOM 6: stn DW 442, 20°54′ S, 167°17′ E, 200 m, 1dd (holotype).
New Caledonia. LAGON: stn 830, 20°49′ S, 165°19′ E, 105-110 m,1 dd (paratype).

DISTRIBUTION. — Only known from material listed above, 105-200 m; no live material collected.

DESCRIPTION. — *Protoconch* (Figs 43-44): smooth, globular, hyperstrophic, at about 110° angle to the teleoconch axis; with embryonic whorl exposed; multispiral, consisting of about 2 1/2 whorls; PD 480-500 µm; with weak, hardly elevated peritreme. Weak, curved anal keel (ca. 80 µm) bordering deep umbilicus; protoconch umbilicus completely covered by thin, reddish-brown lamella extending between first TW and anal keel. Glassy white; suture lined with brown.

Teleoconch (Figs 40-41): slender cone-shaped, base acutely angled; 3.7-4.4 mm at 5 1/8 to 6 1/8 whorls, spire angle about 22°. Pattern of regular spiral and axial ribs, intersecting at approximately right angles to form nodules. Spacing of the axials very regular, with ca. 26 on fourth whorl. Exposed upper part of earlier whorls with 3 spiral ribs (lowermost strongest), joined (below the uppermost) by a fourth rib at about 2 1/4 to 3 1/4 TW, so that spiral sculpture consists of 2 pairs of ribs, with lowermost pair stronger (Fig. 45). Upper point of whorl attachment at a recessed, fifth spiral rib, partly covering it. On body whorl, this rib, and one of almost equal strength below it, forming double keel at outer base. Straight, somewhat recessed basal area with 4-6 spiral threads and weak axial threads (Fig. 42). Umbilicus not open. Coloration: milk-white, with tan rectangular blotches extending to full height of exposed whorl; about 5-7 blotches per whorl, each 2-6 nodules wide; pattern not coordinated between neighboring whorls; pigment darkest on spiral ribs.

Animal: unknown.

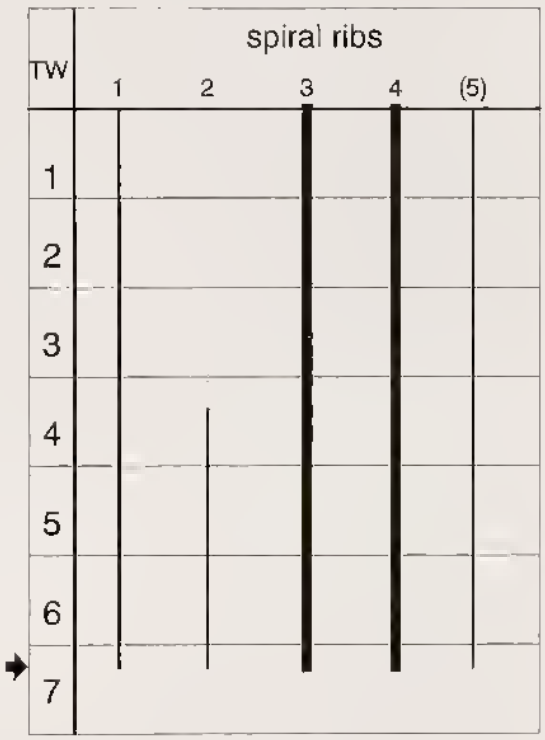


FIG. 45. — *Mathilda maculosa* sp. nov. Diagram of spiral sculpture, as in Fig. 8.

Measurements:

	H	D	PD	TW	Locality	Collection
Holotype	4.4	2.0	480	6 1/8	[type loc.]	MNHN
Paratype	3.7	1.8	500	5 1/8	LAGON stn 830	FMNH 224969

REMARKS. — This form is readily recognized by its slender shell with regular spiral pattern (changing from 3 to 4 well-defined ribs, Fig. 45), its relatively small protoconch and the unusual color pattern. The pattern is relatively faint on the dead-collected type specimens and does not reproduce well in black-and-white light photographs (Fig. 41). It is probably considerably darker in living specimens. The post-first-whorl "2+2" pattern of primary spiral ribs is similar to that of *Mathilda decorata* (discussed above).

Source : MNHN, Paris

ETYMOLOGY. — *Maculosus, a, um* (Latin adjective): spotted.

Other Indo-Pacific forms with "2+2" rib pattern

The following four nominal species have all been described from Japan. All are tall and slender forms, sharing a basic "2+2" sculptural pattern of four exposed major spiral ribs with the two lower ones strongest, and all have additional spiral threads interspersed at least on later whorls. The type material was not available for direct study and present information does not allow a more critical assessment of these taxa.

(1) *Mathilda cancellata* Kuroda, 1958 (Fig. 46)

Mathilda cancellata Kuroda, 1958: 24-25, pl. 21, fig. 13 (holotype).

Other references:

Mathilda cancellata – AZUMA, 1960: 12; Hanshin Shell Club, 1986: 37.
Opimilda cancellata – KURODA & HABE *in* KURODA *et al.*, 1971: 414, 259, pl. 61, fig. 5 (21 mm color photograph). — HIGO, 1973: 227. — SPRINGSTEEN & LEOBRERA, 1986: 57, pl. 12, fig. 10 (26 mm color photograph). — HIGO & GOTO, 1993: 351.

TYPE LOCALITY AND MATERIAL (KURODA, 1958: 25): "Off Tosa, Shikoku I., collected by Akibuni Teramachi, and the type specimen belongs to his collection." Holotype dimensions given as "At. [*sic*] 19.4, diam. 7.5"; the original description mentions about 11 whorls including less than one on the apex for the protoconch. The shell is described as thin, subtransparent, waxen white, narrowly umbilicate.

(2) *Mathilda cerea* Kuroda, 1958 (Fig. 47)

Mathilda cerea Kuroda, 1958: 27, pl. 21, fig. 14 (holotype).

Other references:

Mathilda cerea – AZUMA, 1960: 12. — Hanshin Shell Club, 1986: 37, pl. 14, figs 7-8 (holotype, dimensions given as "25.0 × 7.0 mm").
Opimilda cerea – HIGO, 1973: 227. — HIGO & GOTO, 1993: 351.

TYPE LOCALITY AND MATERIAL (KURODA, 1958: 27): "Off Tosa, also collected by A. Teramachi". "[Holotype] whorls 13.5, the apex defective, with the alt. 25.0 and diam. 7.1 mm ... The paratype specimen, with 13 whorls with a heterostrophe protoconch (number of whorls is not cetain [*sic*] somewhat by erosion), measuring 23.0x7.8 mm., in Teramachi's collection." Described as being similar to *Mathilda quinquelirata* (see discussion under *M. salve*, above), "but much slender, fleshy corneous, spiral ribs are more slender and sharper, with a much less granular appearance".

(3) *Mathilda gemmulifera* Kuroda, 1958 (Fig. 48)

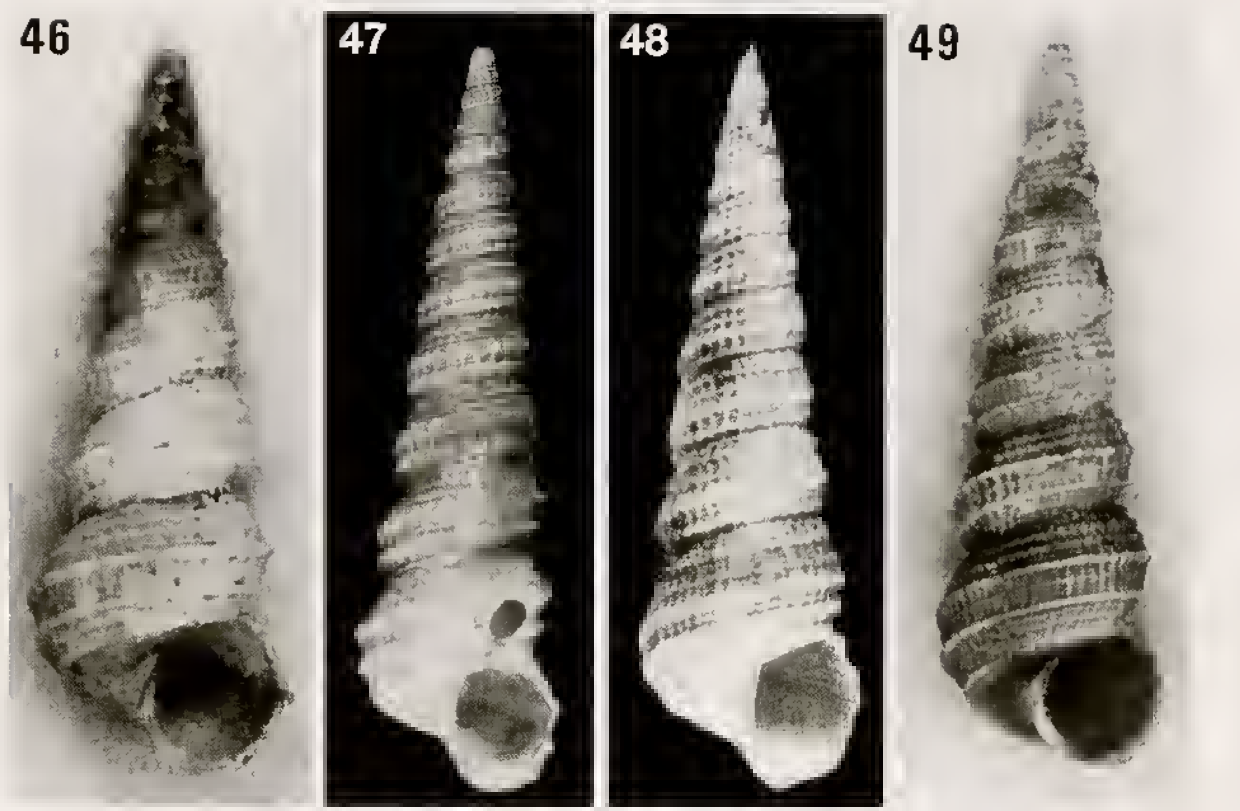
Mathilda gemmulifera Kuroda, 1958: 27, pl. 21, fig. 11 (holotype).

Other references:

Mathilda gemmulifera – AZUMA, 1960: 12. — Hanshin Shell Club, 1986: 42.
Mathilda cerea [*sic*] *gemmulifera* – Hanshin Shell Club, 1986: pl. 15, figs 1-2 (holotype, dimensions given as "24.0 × 7.0mm").
Opimilda gemmulifera – HIGO, 1973: 227. — HIGO & GOTO, 1993: 351.

TYPE LOCALITY AND MATERIAL (KURODA, 1958: 27): "Type specimen only, collected by A. Teramachi at off Tosa, and is said to have been obtained from a depth of about 100 fms." Holotype dimensions given as "Alt. 24.6, diam. 7.3mm." Described as having "whorls 13, plus a glossy and

Source : MNHN, Paris



FIGS. 46-49. — Nominal species from Japan with unresolved taxonomic status. — **46**, holotype of *Mathilda cancellata*, "19.4 mm" (light photograph courtesy Prof. HABE). — **47**, holotype of *Mathilda cerea*, "25.0 mm" (light photograph taken from publication by Hanshin Shell Club 1986). — **48**, holotype of *Mathilda gemmulifera*,"24.0 mm". (light photograph taken from publication by Hanshin Shell Club 1986). — **49**, holotype of *Opimilda scalaris* Kuroda & Habe, 1971, "21.5 mm" (light photograph courtesy Prof. HABE).

depressed helicoid, heterostrophe protoconch of 2 whorls with a rounded periphery, its axis being at right angles to that of the later volutions." The original description compares the shell to *Mathilda cerea* (see above), "but differing in that the coloration is slightly paler, more glossy and less sharply angular, with somewhat convex whorls; size of the 3 spiral ribs except the peripheral one nearly similar to one another."

(4) *Mathilda scalaris* (Kuroda & Habe *in* Kuroda *et al.*, 1971) (Fig. 49)

Opimilda scalaris Kuroda & Habe *in* Kuroda, Habe & Oyama, 1971: 415, 259-260, pl. 61, fig. 4 (22 mm color photograph of holotype).

Other references:

Opimilda scalaris — HIGO, 1973: 227. — HIGO & GOTO, 1993: 351.

TYPE LOCALITY AND MATERIAL (KURODA & HABE *in* KURODA *et al.*, 1971: 259-260): "Sagami Bay (alive); Jogashima W 5 km (110-150m) [Japan]". Holotype "Height 21.5 mm and breadth 6.3 mm." The original description reads: "Shell turreted in shape, thin, yellowish white. Whorls consists of 11.5 whorls, two of which sinistrally coiled, smooth, polished protoconch obliquely placed on the teleoconch. Teleoconch whorls somewhat convex with deeply constricted sutures, surrounded by the strong spiral cords, one on the periphery and two between periphery and lower suture, and many weak spiral threads crossed by the lamellate growth lines forming granules at the crossing points as

Source : MNHN, Paris

well as reticulated sculpture at the interspaces. Base of the body whorl rather flat, encircled by two spiral cords and sculptured with 6-7 threads crossed by the growth lines. Outer margin of the aperture thin, roundly curved and columellar margin thickened and gently curved". The type specimen is in the Imperial Household's Biological Laboratory collection (*teste* INABA & OYAMA, 1977: 108) and could not be obtained on loan (MATSUKUMA *in litt.*, HABE *in litt.*).

Mathilda fusca (Okutani & Habe, 1981)

Figs 50-53

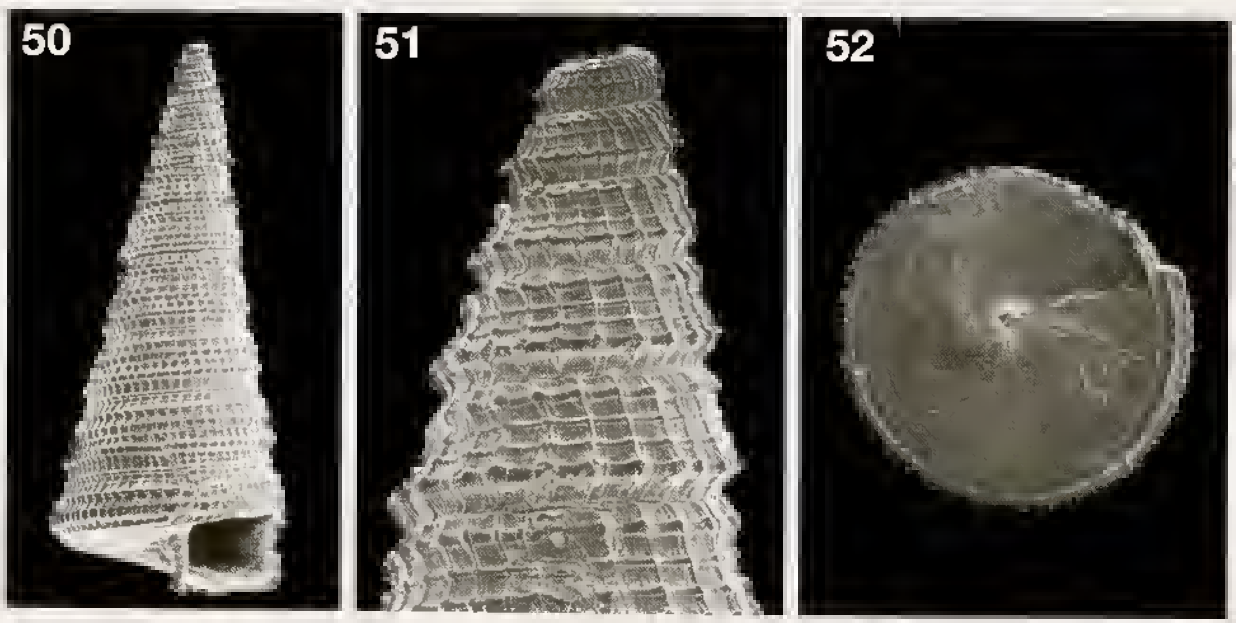
Orectospira fusca Okutani & Habe, 1981: 197-199, fig. 1.

Other reference:
Orectospira fusca – HIGO & GOTO, 1993: 103.

TYPE MATERIAL. — The unique type specimen was described by OKUTANI & HABE (1981: 197-198) as having about 17 teleoconch whorls and a smooth, darkish brown, "mamillar" protoconch with 1.5 whorls. Dimensions were given as "Height 51.7 mm, breadth 21.1 mm, H/B = 2.45, diameter of operculum 7.1 mm". The holotype specimen was in the private collection of S. Hayashi, the original collector. After his death, the collection was bought by a private collector in Tokyo (Mr. Ito; *teste* T. OKUTANI, 7.XII.1990, *in litt.*). The specimen was not available on loan for the present study, but Prof. OKUTANI kindly arranged for a color photograph of the specimen in its current condition ("The protoconch was lost and the apertural lip is a little chipped"; T. OKUTANI, *in litt.*).

TYPE LOCALITY. — "Southwest of Shionomisaki, Kii Peninsula, about 450 m deep", Pacific coast of Japan.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 36, 23°09′ S, 167°11′ E, 650-680 m, 1 dd. — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 3 dd [including SEM specimen], 1 lv [used in ongoing anatomical study].
SMIB 3: stn DW 7, 24°55′ S, 168°21′ E, 505 m, 1 dd.



FIGS. 50-52. — *Mathilda fusca*, specimen from New Caledonia, BIOCAL: stn DW 51, 14.2 mm. — **50**, lateral aspect. — **51**, apex (protoconch missing). — **52**, shell base, diameter 6.5 mm.

Source : MNHN, Paris

DISTRIBUTION. — Known from Japan (type locality) and current study area, from 450 to 700 m; live-collected from 450 m (Japan) and 680-700 m.

DESCRIPTION. — *Protoconch* (missing on all but one specimen from BIOCAL: stn DW 51; the following interpretation based on this only partly preserved specimen): smooth; globular; strongly hyperstrophic, embryonic whorl not exposed, part of suture exposed; estimated at 135° to teleoconch axis; number of whorls not ascertained, but more than 1 1/2; approximately 500 µm in maximum diameter; with no distinct peritreme. Glassy white, with protoconch suture tan.

Teleoconch (Figs 50-51): tall cone-shaped, with concave whorl surfaces; very solid and large for family, up to ca. 40 mm at 19 whorls; spire angle 26-27°. Pattern of regular spiral and weaker axial ribs, intersecting at slightly oblique angles to form strong nodules. Spacing of the axials initially very regular, with ca. 26 on fourth whorl, increasing to far over 100 densely-spaced lines on body whorl of large specimens. First whorl bulging, with 3 spiral ribs (middle one weakest, lowermost strongest); beginning with second whorl, regular pattern of 4 major spiral ribs (see Fig. 53; lowermost strongest and most prominent, 2 middle ones (in concave area of whorl) weakest; larger specimens with additional fine threads flanking middle ribs. Upper point of whorl attachment at a recessed, fifth spiral rib, partly covering it. On body whorl, this rib, and one of almost equal strength immediately below it, forming double keel at outer base. Basal area (Fig. 52) with 20-30 relatively regular spiral threads (sometimes alternating in strength). Umbilicus not open. Coloration: light tan, with areas between spiral ribs with reddish tan.

Animal: unknown. Operculum described as "horny, small for the aperturał area, multispiral with partially raised spires" (OKUTANI & HABE, 1981: 198).

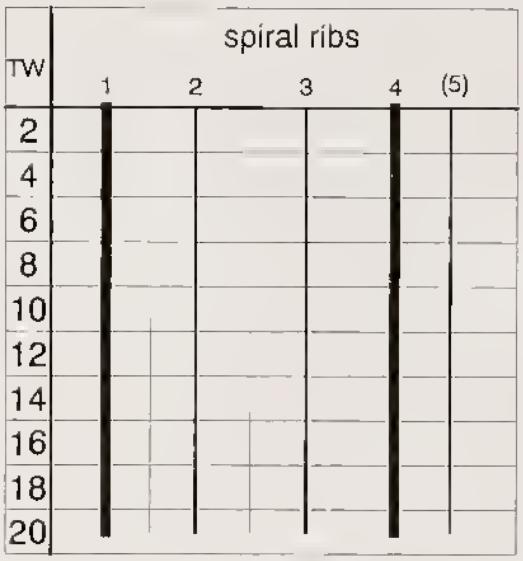


FIG. 53. — *Mathilda fusca*. Diagram of spiral sculpture, as in Fig. 8. Note compressed scale.

REMARKS. — The genus *Orectospira* Dall, 1925 (based on *Basilissa babelica* Dall, 1907, from Honshu, Japan) was originally placed in the Trochidae. HABE (1955) established a subfamily Orectospirinae for this group which he subsequently (1961: 24) raised to family-level. A small number of fossil and Recent species was included by various authors, species that previously had been placed in an array of families ranging from Littorinidae to Cerithiidae (OKUTANI & HABE, 1981). OKUTANI & HABE (1981) recognized only two previously described northwest Pacific species in this deepwater genus, the type species *O. babelica* (Dall, 1907) from *"Albatross"* stn 4973 and *O. tectiformis* (Watson, 1886) from "*Challenger*" stn 235. TSUCHIDA (1986) later synonymized *O. babelica* under *O. tectiformis* and showed that *O. shikoensis* (Yokoyama, 1928), originally described as a Pliocene fossil from Taiwan, occurs as an extant, sympatric species off the coast of Japan. OKUTANI & HABE (1981) described a third nominal species in this genus, *Orectospira fusca*. This species was known to date from the single live-collected type specimen from off Kii Peninsula, Japan. The protoconch (no longer with the type specimen, see Type material above) was described as being "mamillar", without mention of heterostrophy.

Among the material dredged during BIOCAL and SMIB 3 campaigns were several specimens here recognized as conspecific with "*Orectospira*" *fusca*. The nominal species is here transferred to *Mathilda* (*sensu lato*), where it represents the largest living species of its family known to date. The distinct pattern of four spiral ribs (with the two weaker middle ones in a concave zone of the whorl; Figs 51, 53) is already well established in early parts of the shells, and even juveniles would be readily recognizable. The size difference to other mathildid species is a result of the much larger number of whorls; measured to the suture after four whorls, for instance, *M. fusca* and *M. brevicula* both average 2.5 mm. The "1+2+1" primary spiral rib pattern on the exposed part of each teleoconch whorl is not known from other extant mathildids.

True *Orectospira* is thus again restricted to forms with whitish shells with little spiral sculpture. It is also noteworthy that the published information (OKUTANI & HABE, 1981) on the operculum of

Source : MNHN, Paris

"*Orectospira*" is based on this mathildid. HOUBRICK (1990) recently placed *Orectospira* in synonymy of *Trochocerithium* Cossmann & Sacco *in* Sacco, 1896 (Turritellidae).

Mathilda cf. *hendersoni* Dall, 1927

Figs 54-57, 62

? *Mathilda hendersoni* Dall, 1927: 91.

TYPE MATERIAL. — Lectotype (here selected. H = 10.3, D = 4.5, PD = 480 µm, TW = 8 1/2; USNM 333468).

TYPE LOCALITY Here restricted to "Off Fowey Light, Florida coast, in 25 fathoms [46 m]" as given for lectotype lot.

MATERIAL EXAMINED. Lectotype as above.
New Caledonia. LAGON: stn 830, 20°49′ S, 165°19′ E, 105-110 m, 2 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 399, 20°42′ S, 167°00′ E, 282 m, 1 dd.

DISTRIBUTION. — Indo-Pacific records from this study area only, 105-282 m. No live records.

DESCRIPTION. — *Protoconch* (Figs 55-56): smooth, globular, strongly hyperstrophic (approximately 135° to teleoconch axis), embryonic whorl not exposed; multispiral, number of whorls not ascertained: 420-500 µm in maximum diameter; with weak, hardly elevated peritreme. Curved anal keel bordering deep umbilicus, the latter (in well-preserved specimens) completely covered by thin, reddish-brown lamella extending between first teleoconch whorl and anal keel. Glassy white, suture and outer lip lined with brown.

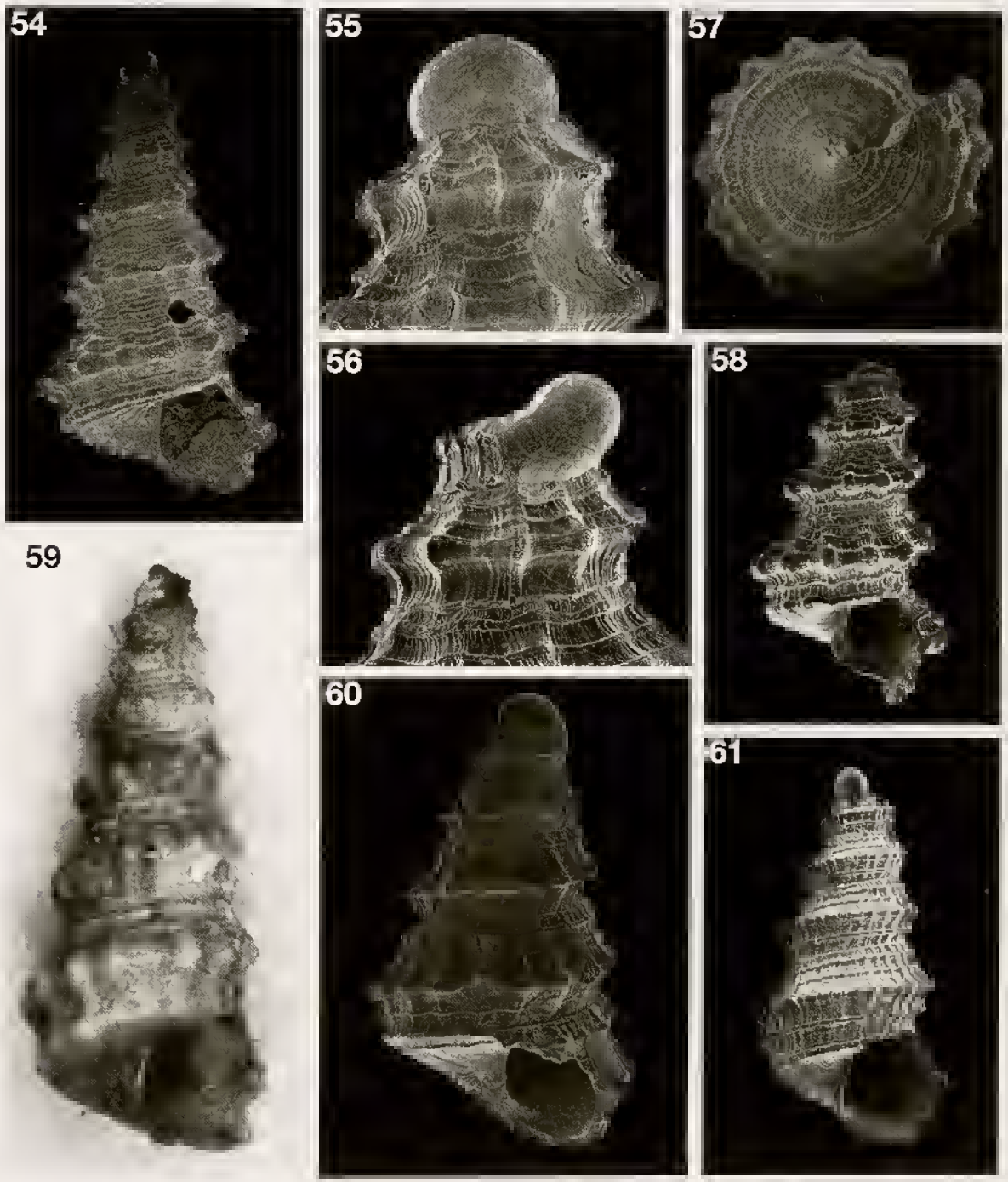
Teleoconch (Fig. 54): slender pagoda-shaped, base acutely angled; 3.1 to 6.2 at 4 1/3 to 6 1/2 whorls. Spire angle 29-30°. Pattern of relatively coarse spiral ribs and axial bulges, intersecting at approximately right angles to form coarse nodules, especially on keel-forming third primary spiral rib; with 12-16 axials on fourth whorl, 16 on body whorl of largest specimen examined. Fine underlying sculpture of axial riblets. Exposed upper part of first whorl with 5 spiral ribs, with the keel-forming middle one strongest. Upper point of whorl attachment initially *below* the fifth spiral rib, resulting in rectangular appearance of first whorl. Beginning with second whorl, point of whorl attachment *on* fifth rib, partly or wholly covering it. Later whorls with additional spiral threads as indicated in Fig. 62 (one specimen with ribs 1, 2, 4 very weak or absent on initial whorls). On body whorl, fifth primary rib and one of almost equal strength below it, forming double keel at outer base. Straight, somewhat recessed basal area (Fig. 57) with 1-4 spiral threads and distinct axial threads, especially in the outer area. Umbilicus open in smaller specimens, partly covered by columellar lip; closed in largest specimen examined. Coloration: off-white to yellowish tan, with nodes on all ribs conspicuously white.

Animal: unknown.

REMARKS. — This form shares a "2 + 1 + 1" primary rib pattern with *Mathilda maoria* (above). It differs from other New Caledonian species in its very strongly developed third rib, resulting in a fir-tree-like appearance. It is very similar to, and may be conspecific with, a species described from the western Atlantic, *Mathilda hendersoni* Dall, 1927. The Atlantic form was not originally figured. A photographic illustration was provided by RIOS (1985: pl. 52, fig. 725), who also summarized the Atlantic depth records as "from 45 to 100 m" (1985: 154). Further comparative studies of additional specimens will be necessary.

Mathilda hendersoni appears to be similar to nominal species *Granulicharilda sagamiensis* Kuroda & Habe *in* Kuroda *et al.*, 1971 (: 416-417, 260, pl. 61, fig. 2). That species is only known from the two type specimens described from Japan ("Height 7.7 mm and breadth 3.3 mm" (holotype): "Height 6.9 mm and breadth 3.2 mm" (paratype) (KURODA & HABE *in* KURODA *et al.*, 1971: 260). The types ("in H. Majesty's Biol. Lab." *teste* INABA & OYAMA, 1977: 104) were not available for this study, but a photograph of the holotype (Fig. 59, courtesy Prof. HABE) is here reproduced. The photograph of the holotype shows a relatively small protoconch, which was described by KURODA & HABE (1971: 260) as having two whorls and being "obliquely placed on the teleoconch." Viewed at

Source : MNHN, Paris



FIGS. 54-61. **54-57**. *Mathilda* cf. *hendersoni*. — **54**, specimen from New Caledonia, LAGON: stn 830, 6.2 mm. — **55-56**, aspects of protoconch and early teleoconch whorls, specimen from Loyalty Islands, MUSORSTOM 6: stn DW 399, FMNH 224966, protoconch diameter 420 µm. — **57**, shell base, same specimen as in Fig. 54, diameter 3.2 mm. — **58**, *Mathilda* sp. aff. *hendersoni*, New Caledonia, LAGON: stn 830, 2.8 mm. — **59**, *Mathilda saganiensis*, holotype of *Granulicharilda saganiensis*, Japan, "7.7 mm" (light photograph courtesy Prof. HABE). — **60**, *Mathilda* sp. aff. *sansibarica*, specimen from New Caledonia, BIOCAL: stn DW 70, 3.8 mm. — **61**, *Mathilda sansibarica*, lectotype ZMB, East Africa, 3.6 mm (SEM, uncoated).

Source : MNHN, Paris

comparable angles, the protoconchs of the New Caledonia material are much larger in relation to the teleoconch. The teleoconch of *G. saganiensis* appears to have about seven whorls (rather than the originally described six). At a shell height of 7.7 mm, *saganiensis* seems to have fewer whorls than the "cf. *hendersoni*" specimens, and the number of body whorl nodules is given as "about 20," while it does not exceed 16 in the "cf. *hendersoni*" material. The largest node-bearing ribs appears to be spirally subdivided in the *saganiensis* type (or two ribs run closely together), a feature not mentioned in the original description.

Mathilda sp. aff. *hendersoni*: a single, small specimen (H = 2.8, D = 1.6, PD = 420, TW = 4; MNHN; Fig. 58) was found with the *M.* cf. *hendersoni* material in New Caledonia. It is similar to *M. hendersoni*, but differs in having a greater degree of heterostrophy (ca. 145°) and by having one strong rib (instead of a double keel) on the outer shell base. The shell is reddish-tan with the nodes on all ribs standing out in white. More, fully grown, specimens are needed for further study.

Likewise currently unassigned (and probably unnamed) are six specimens currently treated as "*Mathilda* sp. aff. *hendersoni/maoria*" (BIOCAL: stn DW 46 and DW 66; CHALCAL 2: stn DW 76). The relatively small specimens (H = 3.5 to 5.1) have teleoconch sculptures reminiscent of *M. hendersoni*, but larger protoconchs (560-600 µm) that are much less hyperstrophic.

Mathilda sp. aff. *sansibarica* Thiele, 1925

Figs 60, 63

MATERIAL EXAMINED. — **New Caledonia.** BIOCAL: stn DW 70, 23°25′ S, 167°53′ E, 965 m, 1 dd.

DESCRIPTION (single specimen). — *Protoconch* (Fig. 60): smooth, globular, strongly hyperstrophic, at about 115° to teleoconch axis; embryonic whorl exposed; about 2 1/2 whorls; 620 µm in maximum diameter; with weak, hardly elevated perilreme. Curved anal keel bordering deep umbilicus, the latter completely covered by thin, reddish-brown lamella extending between first teleoconch whorl and anal keel. Glassy white; suture and outer lip lined with brown; embryonic whorl darker.

Teleoconch (Fig. 60): relatively thin-shelled, translucent; pagoda-shaped, base acutely angled; 3.8 mm at 4 1/10 whorls; spire angle about 38°. Pattern of relatively coarse spiral ribs and axial bulges, intersecting at approximately right angles to form pointed nodules, especially on keel-forming third primary spiral rib; with 22 axials on fourth whorl. Exposed upper part of first whorl with 3 spiral ribs, with the keel-forming middle one strongest. Upper point of whorl attachment initially at a fourth spiral rib, partially covering it. Beginning with second whorl, point of whorl above this rib, wholly covering it; second primary spiral rib fading to become as weak as spiral thread next to it on later whorls. Later whorls with additional spiral threads as indicated in Fig. 63. On body whorl, fourth primary rib and one of almost equal strength below it, forming double keel at outer base. Basal area with ill-defined spiral threads and growth lines. Umbilicus not open. Coloration: white.

Animal: unknown.

REMARKS. — This single-known specimen differs from other New Caledonian material in having a translucent shell with concave shell areas and relatively weak sculpture (Fig. 63).

The specimen is similar in shell features to *Mathilda sansibarica* Thiele, 1925 (: 112, pl. 20, fig. 25). That nominal species is known from two type specimens from off East Africa (lectotype, originally illustrated syntype, here selected: H = 3.6, D = 1.95, PD = 500, TW = 4 1/10 (Fig. 61); paralectotype: H = 4.1, D = 2.1, PD = 500, TW = 4 1/2+; both ZMB unnumbered; type locality: "*Valdivia*", stn 245, 5°27.9′ S, 39°18.8′ E, 463 m; Zanzibar Channel). The *M. sansibarica* type specimens differ mainly in having a well-developed second primary spiral rib, a more prominent fourth primary spiral rib, no additional spiral threads interspaced, and a considerably smaller protoconch size.

Source : MNHN, Paris

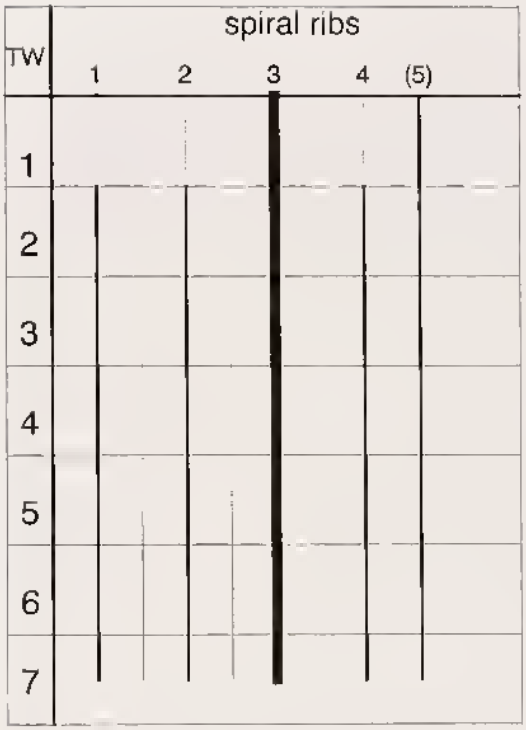


FIG. 62. — *Mathilda* cf. *hendersoni*. Diagram of spiral seulpture, as in Fig. 8. Fifth primary rib exposed on first whorl.

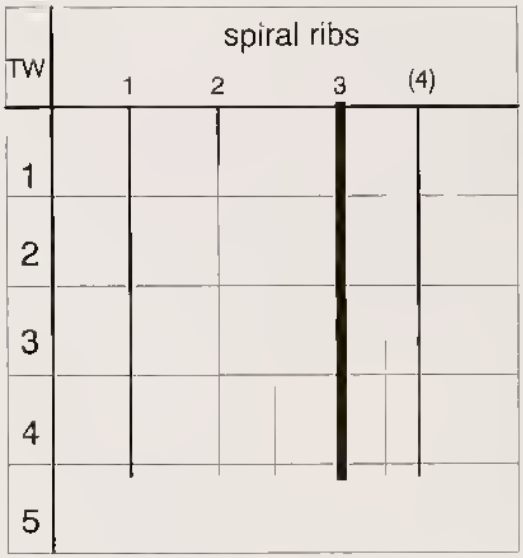


FIG. 63. — *Mathilda* sp. aff. *sansibarica*, diagram of spiral sculpture (based on single specimen), as in Fig. 8.

Mathilda honbricki sp. nov.

Figs 64-68, 73

TYPE MATERIAL. — Holotype MNHN, protoconch damaged.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn CP 75, 22°19' S, 167°23' E, 825-860 m.

MATERIAL EXAMINED. — Only known from the type material.

DESCRIPTION (based on holotype). — *Protoconch* (Figs 65-66): smooth, globular, hyperstrophic, at about 115° to teleoconch axis; embryonic whorl exposed; multispiral, consisting of ca. 2 1/2 whorls; 620 µm in maximum diameter; with weak peritreme. Curved anal keel bordering deep open umbilicus; 160 µm long reddish-brown lamella extending from protoconch lip (Fig. 66), partly covering umbilicus. White; embryonic whorl brown.

Teleoconch (Figs 64, 68): cone-shaped with somewhat bulging whorls; 5.9 mm in height at somewhat over 5 whorls; spire angle 35°. Pattern of regular spiral and axial ribs, intersecting at approximately right angles to form nodules; axials about as strong as weakest spirals. Spacing of the axials very regular, with ca. 36 on fourth whorl. Initial part of first postlarval whorl with 2 weaker and 2 stronger (keel-forming) spiral ribs exposed and upper point of whorl attachment on a fifth rib (partly covering it; Fig. 68). Already on first whorl with 2 additional ribs developing between first, second and third primary spirals, quickly reaching a strength almost identical to that of first and second. After about 3 whorls, this 4+**2** pattern supplemented by additional finer spiral threads (between and below the 2 stronger ribs; Fig. 73). On body whorl, the fifth primary spiral rib (seventh in total) and one of almost equal strength below it, forming rounded keel-area on outer base. Basal area (Fig. 67) with about 9 weak, flattened spiral ribs of various width, intersected by weak axial threads fading out as irregular growth lines. Umbilicus not open. Coloration: milk-white.

Animal: unknown.

Measurements: H= 5.9, D= 3.3, PD= 620, TW= 5+.

REMARKS. — This form differs from other mathildid species by its relatively broad shell with an original "2+**2**" pattern of exposed primary spiral ribs rapidly developing into a "4+**2**" pattern (Figs 65-66, 73).

Source : MNHN, Paris

FIGS. 64-72. — **64-68**, *Mathilda houbricki* sp. nov., holotype, New Caledonia, 5.9 mm. — **64**, lateral aspect. — **65-66**, aspects of protoconch and first teleoconch whorl, protoconch diameter 620 µm. — **67**, shell base, diameter 3.3 mm. — **68**, shell apex. — **69-72**, *Mathilda richeri* sp. nov., holotype, New Caledonia, 13.7 mm. — **69**, lateral aspect. — **70**, shell apex. — **71**, protoconch and part of first teleoconch whorl (eroded), showing nuclear whorl on the right, protoconch diameter 600 µm. — **72**, shell base, diameter 5.8 mm.

ETYMOLOGY. — Named for the late Dr Richard ("Joe") HOUBRICK, curator at the National Museum of Natural History in Washington, DC.

Mathilda richeri sp. nov.
Figs 69-72, 74

TYPE MATERIAL. — Holotype MNHN.

TYPE LOCALITY. — New Caledonia, BIOCAL, stn DW 48, 23°00′ S, 167°29′ E, 775 m.

MATERIAL EXAMINED. — Only known from the type material.

Source : MNHN, Paris

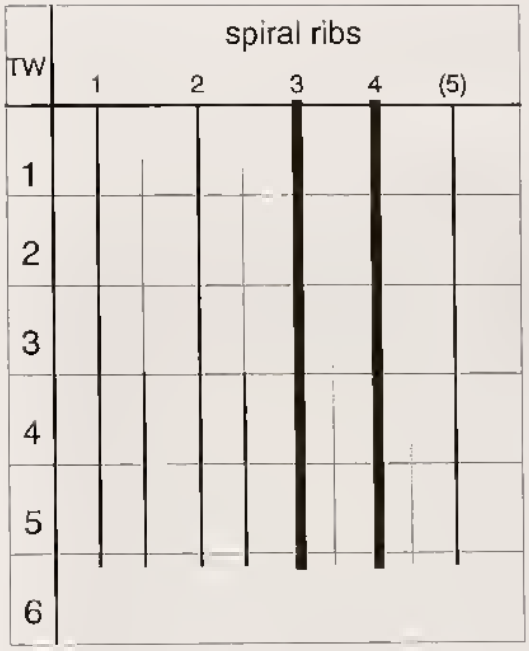


FIG. 73. — *Mathilda houbricki* sp. nov. Diagram of spiral seulpture (holotype), as in Fig. 8.

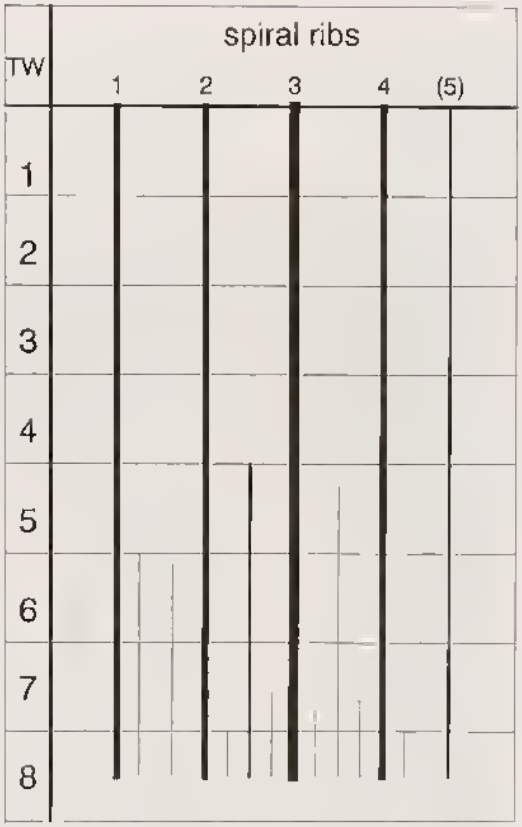


FIG. 74. — *Mathilda richeri* sp. nov. Diagram of spiral sculpture (holotype), as in Fig. 8.

DESCRIPTION (based on holotype). — *Protoconch* (Fig. 70): smooth; globular: hyperstrophie, embryonie whorl partly exposed, approximately 120° to teleoconch axis; multispiral, consisting of ca. 2 1/2 whorls; 600 µm in maximum diameter; peritreme weak; umbilieus open (some remnants of callus and/or anal keel visible). White, embryonic whorl darker.

Teleoconch (Fig. 69): cone-shaped with somewhat bulging whorls; 13.7 mm in height at somewhat over 7 1/2 whorls; spire angle ca. 35°. Primary pattern of 4 spiral and numerous axial ribs, intersecting at approximately right angles to form nodules; third spiral somewhat stronger and most prominent, fourth spiral initially weakest. Spacing of axials regular, with ca. 26 on fourth whorl. After first 3 teleoconch whorls with additional ribs developing between primary spirals, some of which are later flanked by additional threads after 6 whorls (see Fig. 74). Whorl attachment on a fifth primary spiral; this rib and one of almost equal strength below it demareating basal perimeter. Basal area with about 9 weak, flattened spiral ribs and threads of various width, interseeted by irregular axial growth lines. Umbilicus not open. Coloration: milk-white.

Animal: unknown.

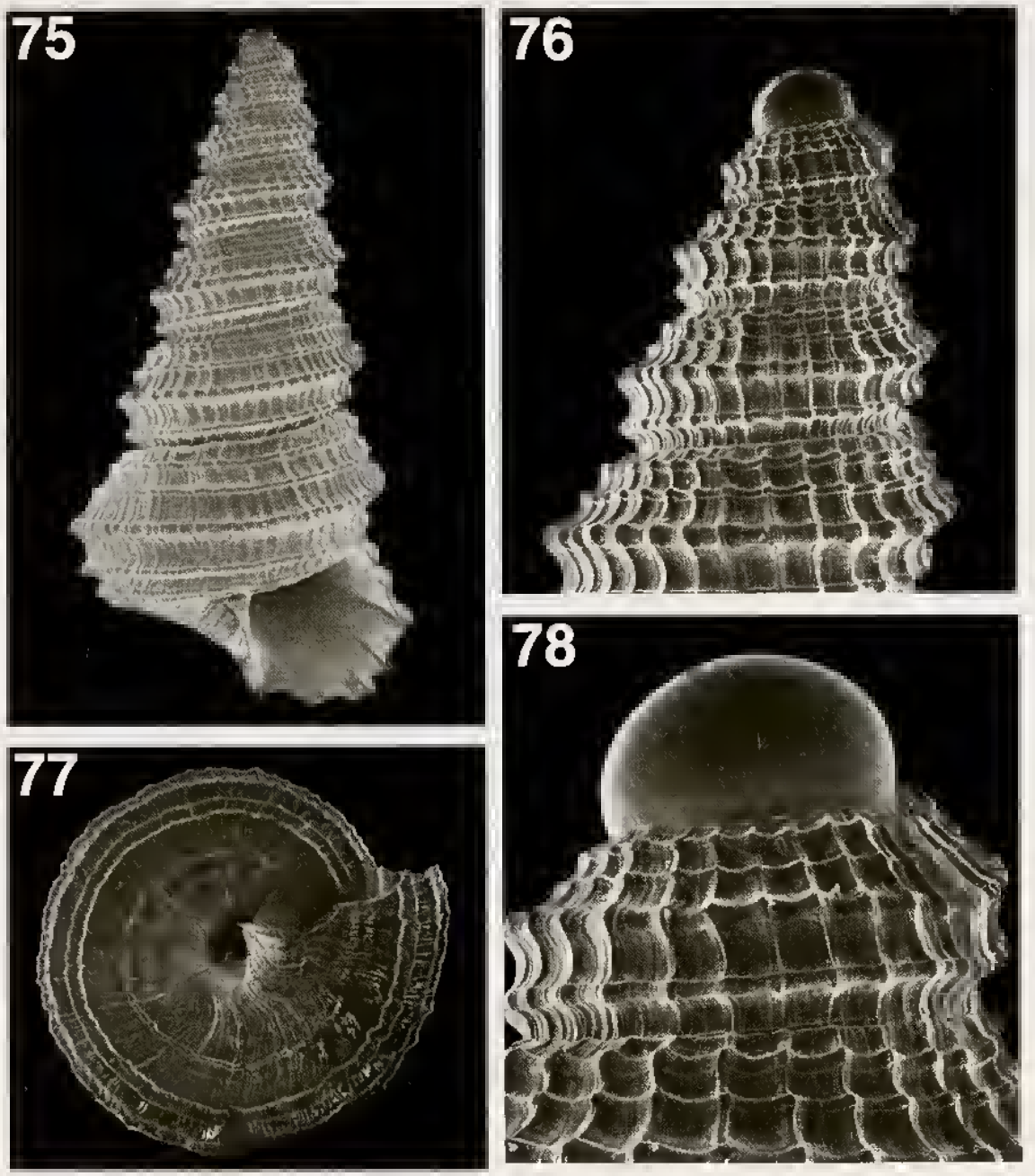
Measurements: H = 13.7, D = 5.8 (shell originally wider; body whorl broken back, exposing part of columella), PD = 600, TW = 7 1/2.

REMARKS. — This form is readily recognized by its relatively broad shell, prominent third spiral rib, and numerous interspaced spiral threads on later whorls. The initial "2+1+1" pattern of exposed primary spiral ribs (Figs 70, 74) is reminiscent of the *Mathilda maoria* complex (discussed above). *Mathilda houbricki* sp. nov. (above) is somewhat similar in overall shell shape.

A similar shell from the same station differs in having the interspacing threads beginning earlier (already on the second whorl) and by having the upper point of whorl attachment on the fourth, not fifth, primary spiral. The specimen shows two major shell repairs on the second whorl and the sculptural patterns may thus not be species-specific. The specimen (MNHN) was not included in above description.

Source : MNHN, Paris

ETYMOLOGY. — Named for Dr Bertrand RICHER DE FORGES, who participated on the BIOCAL campaign and was one of the collectors of the new species. His "Programme LAGON," conducted for ORSTOM between 1984 and 1989 in the coral reef lagoons of New Caledonia, provided many of the mathildid specimens used in the present study.



FIGS 75-78. — *Mathilda* sp. A, New Caledonia, CHALCAL 2: stn DW 72, 10.4 mm. — **75**, lateral aspect. — **76**, shell apex. — **77**, shell base showing open umbilicus, diameter 4.8 mm. — **78**, aspect of protoconch and first teleoconch whorl, protoconch diameter 540 µm.

Source : MNHN, Paris

Mathilda sp. A

Figs 75-79

MATERIAL EXAMINED. — **New Caledonia**, CHALCAL 2, stn DW 72, 24°55' S, 168°22' E, 527 m. 1 lv.

DESCRIPTION (based on single specimen). — *Protoconch* (Fig. 78): smooth, globular, strongly hyperstrophic, estimated at ca. 135° to teleoconch axis; only small part of suture exposed; number of whorls not ascertained; 540 µm in maximum diameter; peritreme weak; protoconch umbilicus completely covered by thin lamella extending between first TW and anal keel. Transparent-white, with lamella, area before peritreme, anal keel, and suture reddish-brown.

Teleoconch (Figs 75-76): cone-shaped; 10.4 mm in height at 7 3/8 whorls; spire angle ca. 32°. Primary pattern of 4 spiral (see Fig. 79) and numerous axial ribs, intersecting at approximately right angles to form nodules; the third and fourth spirals initially stronger and similarly prominent, beginning with the fourth whorl, the third clearly strongest and most prominent. Spacing of axials initially regular (with 30 on fourth whorl), beginning with sixth whorl, axials becoming weaker and their spacing becoming increasingly crowded, eventually representing little more than axial growth marks. Whorl attachment on a fifth primary spiral under formation of a distinct suture; this rib and one of almost equal strength below it demarcating basal perimeter. Basal area (Fig. 77) with about 5 weak, very irregular spiral ribs and threads (intersected by irregular axial growth lines), surrounding narrow (ca. 0.5 mm) but well-developed, open umbilicus. Columellar lip thin, not reflected over umbilicus. Coloration: overall milk-white; early whorls with tan hue. Tan, scaly periostracum covering shell.

Animal: single known specimen has dried-in animal with flat horny operculum visible in aperture (pending further study).

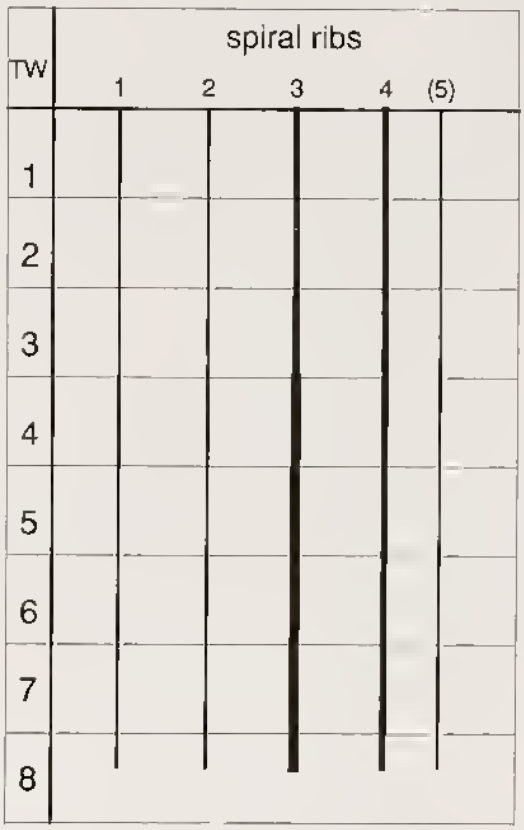


FIG. 79. — *Mathilda* sp. A. Diagram of spiral sculpture, as in Fig. 8.

Measurements: H = 10.4, D = 4.8, PD = 540, TW = 7 3/8.

REMARKS. — This form differs from the others by its combination of a strongly hyperstrophic protoconch, an open umbilicus, distinct "2+2" primary spiral rib pattern, strong spiral sculp-sculpture on the base, and fading axials on the final whorls. The specimen was apparently live-collected, its light shell color not due to fading. Additional material is needed for a more detailed taxonomic assessment.

Genus *TUBA* Lea, 1833

Tuba Lea, 1833: 127. Type species (SD by COSSMANN, 1912: 13): *Tuba alternata* Lea, 1833; Eocene.

The concept of *Tuba* (*sensu lato*) here also includes *Gegania* Jeffreys, 1884 (: 365) with type species by monotypy *Gegania pinguis* Jeffreys, 1884 (Recent, off Portugal), and *Tubena* Marwick, 1943 (: 188), with type species (OD) *Gegania* (*Tubena*) *viola* Marwick, 1943 (Miocene, New Zealand).

DIAGNOSIS for ***Tuba*** *(sensu lato)* **(shell characters)**. — *Protoconch*: diameter 580-820 µm, strongly hyperstrophic ("upside-down"), diverging over 140° from teleoconch axis; with about 2.5 whorls; smooth, glassy, without distinct sculptural elements other than short, curved anal keel and thin callus, the latter covering the protoconch umbilicus (noticeable only in well-preserved

Source : MNHN, Paris

specimens); transparent or milk-white with tan pigmentation often on embryonic whorl, suture, anal keel and callus.

Teleoconch: length usually 4.1 to 10 mm at 3 3/4 to 4 3/4 whorls, but up to 26.5 mm at 7 whorls; broadly cone-shaped with bulging whorls; periphery and base rounded (juveniles with double keel), aperture round, apertural lip slightly channeled at columella and beneath major spiral ribs; teleoconch with primary sculpture of 4-5 spiral ribs (often with interspaced additional ones after first whorl), 1 or 2 of the main spiral ribs markedly more prominent than the others; spiral ribs crossed (at right angle or following the sometimes strongly sinuous shape of apertural lip) by weaker axial ribs, threads or enhanced growth lines; at rib intersections, usually with sculpture of rounded more-or-less coarse nodules, spiral rib interspaces cancellate due to axial ribbing; upper point of attachment of the following whorl at a spiral rib less prominent than at least one of the exposed ribs above; this attachment rib, with an additional rib next to it, forming a distinct double edge at outer shell base; flat, concave or slightly inflated basal area with several more-or-less well-defined spiral threads or ribs, surrounding solid columella, narrow umbilical chink, or funnel-shaped umbilicus; white, sometimes with brown spiral ribs.

REMARKS. — ***Tuba sensu lato***. *Tuba* Lea, 1833, was introduced for three species from the Tertiary of Alabama. Most authors later accepted synonymy of this nominal taxon with JEFFREYS' (1884) *Gegania*, but the older name *Tuba* was often thought preoccupied and thus unavailable. However, *Tuba* Lea, 1833, and its type species *Tuba alternata* were placed on the official ICZN lists as being available, all earlier introductions of the same generic name deemed *nomina nuda* or occurring in works rejected for nomenclatural purposes (ICZN Opininion 436, 1957). JEFFREYS (1884: 365) based *Gegania* on *G. pinguis*, described as differing from *Mathilda* "in having a short spire and an intorted but not a heterostrophe nucleus." He erroneously interpreted the highly hyperstrophic protoconch (of which only the base is exposed on the shell apex) as homeostrophic. *Tubena* Marwick, 1943, was introduced as a subgenus of *Gegania*. MARWICK (1943: 188) saw *Tubena* to differ from *Gegania pinguis* in being umbilicate and in having better developed axial sculpture. However, as is demonstrated by the *Tuba* material from New Caledonia, these features appear to be variable.

Tuba valkyrie (Powell, 1971)

Figs 80-86

Gegania valkyrie Powell, 1971: 210, fig. 1.

Other references:

Gegania valkyrie — CLIMO, 1975: 275 ff., figs 1 (shell), 2-3, 5d (anatomy and radula), 4i-k (eggs). — POWELL, 1976: 107; 1979: 250. — HASZPRUNAR, 1985: 201 ff., figs 1, 3, 12-14 (anatomy). — BIELER, 1988: 213 ff., fig. 4 (sketch of radula after CLIMO, 1975), fig. 14 (SEM of protoconch).

TYPE MATERIAL. — Holotype AIM AK71328; H = 14.3, D = 8.8, PD = 780, TW = 5 1/4 (outer lip broken, large hole in fourth whorl).

TYPE LOCALITY. — "E.S.E. of the Poor Knights Islands, 329 m" [New Zealand].

MATERIAL EXAMINED. — **New Zealand**. Holotype as above.

North Cape, National Museum Northland Expedition, R.V. *"Acheron"*, Biological Station BS 402, 170 m, 20.11.1974 (material also studied by CLIMO [1975] and HASZPRUNAR [1985]: 2 dd, 2 lv (NMNZ M36712).

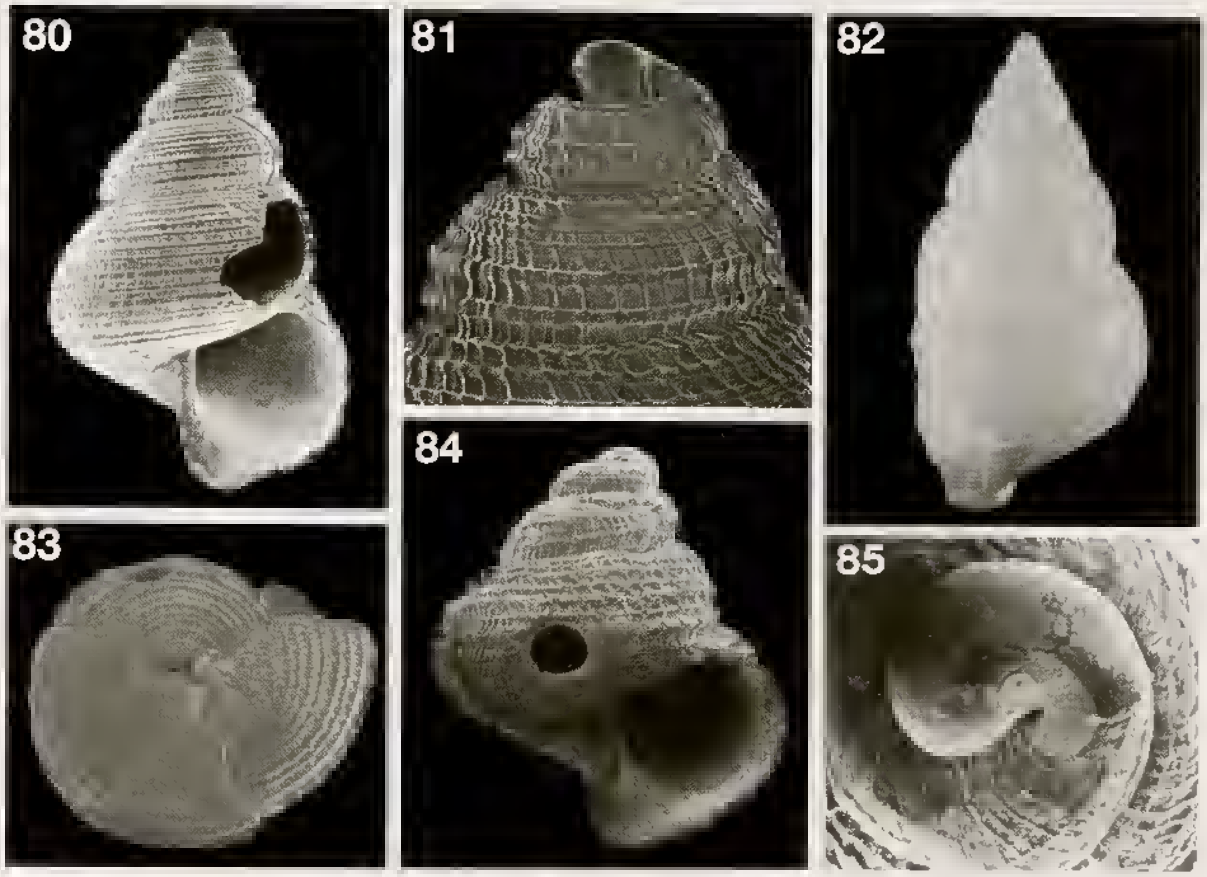
New Caledonia. BIOCAL: stn DW 66, 24°55' S, 168°22' E, 505-515 m, 2 lv.

MUSORSTOM 4: stn DW 212, 22°47' S, 167°10'E, 375-380 m, 1 lv.

Loyalty Islands. MUSORSTOM 6: stn DW 394, 20°49' S, 167°09' E, 570 m, 1 dd. — Stn DW 468, 21°06' S, 167°33'E, 600 m, 1 dd (SEM specimen, FMNH 224967).

Réunion. MD32: stn DC 112, 20°53' S, 55°09' E, 740-780 m, 8 dd.

Source : MNHN, Paris



FIGS. 80-85. — *Tuba valkyrie*. — **80-81**, holotype AIM AK 71328, New Zealand, shell length 14.3 mm (SEM, uncoated). — **82**, light photograph of large specimen from Loyalty Islands, MUSORSTOM 6: stn DW 394, shell length 26.5 mm. — **83-84**, specimen from Loyalty Islands, FMNH 224967, MUSORSTOM 6: stn DW 468; shell base diameter 3.0 mm, shell length 3.2. — **85**, aspect of protoconch and first teleoconch whorl, specimen from New Zealand, NMNZ M36712, protoconch diameter 640 µm.

DISTRIBUTION. — The new record from Réunion indicates that this species is widely distributed in (at least the southern parts of) the Indo-Pacific. Known depth range is 170-780 m, with live records from 170-515 m.

DESCRIPTION. — *Protoconch*: smooth, globular, strongly hyperstrophic, almost completely upside-down (over 145° to teleoconch axis; consisting of ca. 2 1/2 whorls [counted on specimen from Réunion], all but final half whorl hidden; 600-780 µm in maximum exposed diameter; with weak, hardly elevated peritreme. Weak, curved anal keel (ca. 80 µm) bordering deep umbilicus; protoconch umbilicus completely covered by thin, reddish-brown lamella extending between first TW and anal keel. Glassy or milk-white; anal keel lined with brown; on some specimens with brown hue, especially near peritreme.

Teleoconch: with initially somewhat angular, later regularly bulging whorls; average size 5-10 mm at 3 3/4 to 4 3/4 whorls, but large specimens to 26.5 mm at 7 whorls; spire angle initially up to 68°, on later whorls more slender (to 53°); lower apertural lip drawn into open, shallow channel. Shell thin, shiny, especially in cancellate "windows" translucent. Distinct 'arrested growth' mark at ca. 1/6 TW. Fine pattern of spiral ribs intersected by weaker axials; axials following growth lines in a sigmoidal curve arching backward (opisthocyrt), about equal in strength to weakest spiral rib. Exposed upper part of earlier whorls with two groups of 3 spiral ribs; first group of about equal strength, sometimes joined by a weaker fourth (subsutural) rib; second group, forming angular side of whorl above the attachment of the subsequent whorl, with upper and lower ribs strongest. Fourth main rib of the angular region serving as upper point of whorl attachment, occasionally fully exposed on later whorls. On later whorls with additional ribs as shown in Fig. 86 and difference in rib strength fading, resulting in regularly cancellate pattern, with the spiral ribbing strongest. Often with fine additional threads interspersed on later whorls. Base with about 12-15 spiral ribs, somewhat differing in strength, strongest toward periphery. Initially with narrow, open umbilicus, on later whorls closed by reflected columellar lip. Spacing of the axials on the upper side usually regular (35 on second TW, 42 on third, ca. 40 on fourth [New Zealand specimens]), but often extremely crowded from stages of slow growth and on base due to converging axial riblets, especially close to umbilicus. Coloration: white.

Animal: described by CLIMO (1975) and HASZPRUNAR (1985).

Source : MNHN, Paris

REMARKS. — *Tuba valkyrie* was originally described from a single, somewhat worn specimen collected off the Poor Knights Islands, New Zealand (POWELL, 1971) (Figs 80-81). Based on six additional specimens, collected alive off North Cape (New Zealand), CLIMO (1975) described anatomical aspects and reported on radula, egg mass and the presumed food organism, antipatharian coral *Parantipathes tenuispira* Silberfeld. More detailed anatomical information was added by HASZPRUNAR (1985: 201 ff.). CLIMO (1975) also provided SEM photographs of the shell. His illustrations of a protoconch of the North Cape material (CLIMO, 1975: fig. 1) led HASZPRUNAR (1985: 207) to the conclusion that *T. valkyrie* shows "only traces" of a hyperstrophic condition. BIELER (1988: 219, fig. 14) reexamined North Cape specimens by SEM and verified the presence of a strongly hyperstrophic condition in this species (Fig. 85).

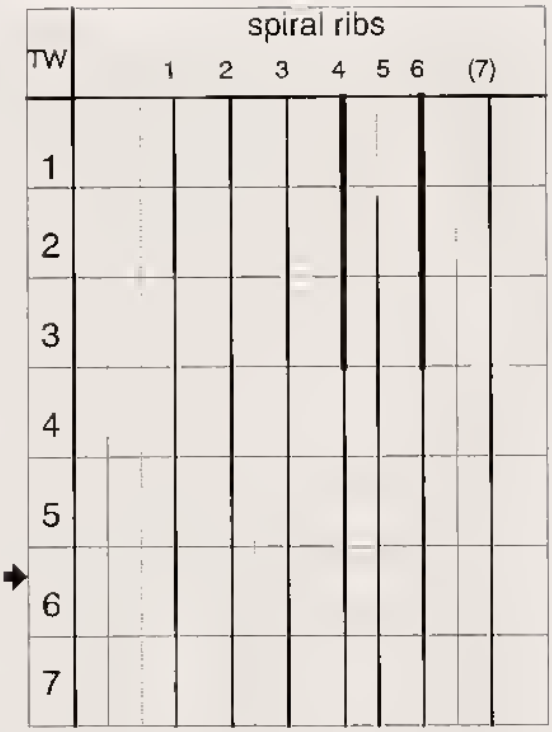


FIG. 86. — *Tuba valkyrie*. Diagram of spiral sculpture, as in Fig. 8.

The strongly opisthocyrt riblets facilitate recognition of this form. A smaller, somewhat worn Loyalty Island specimen shows several shell repairs (at 1 and 2 1/3 and 2 2/3 TW), the outer lip is somewhat broken back in its central part (Fig. 84). The animal apparently died from the attack of a predatory snail, as indicated by a complete bore hole in the body whorl. A larger specimen (Fig. 82) is the largest shell of an extant *Tuba* species recorded to date. The two largest specimens studied (including the holotype) also have unusually large protoconchs (700 and 780 µm, as opposed to 600-680 µm for all others studied).

Tuba fuscocincta sp. nov.

Figs 87-91

TYPE MATERIAL. — Holotype NMP C8591/T1185. Paratype MNHN.

TYPE LOCALITY. — Transkei, off Nthionyane River, 32°17.4′ S, 29°05.6′ E, 340-450 m, RV *"Meiring Naudé"*, stn D12, 5.VII.1985, Kilburn coll. Paratype from New Caledonia, BIOCAL, stn DW 77, 22°15′ S, 167°15′ E, 440 m .

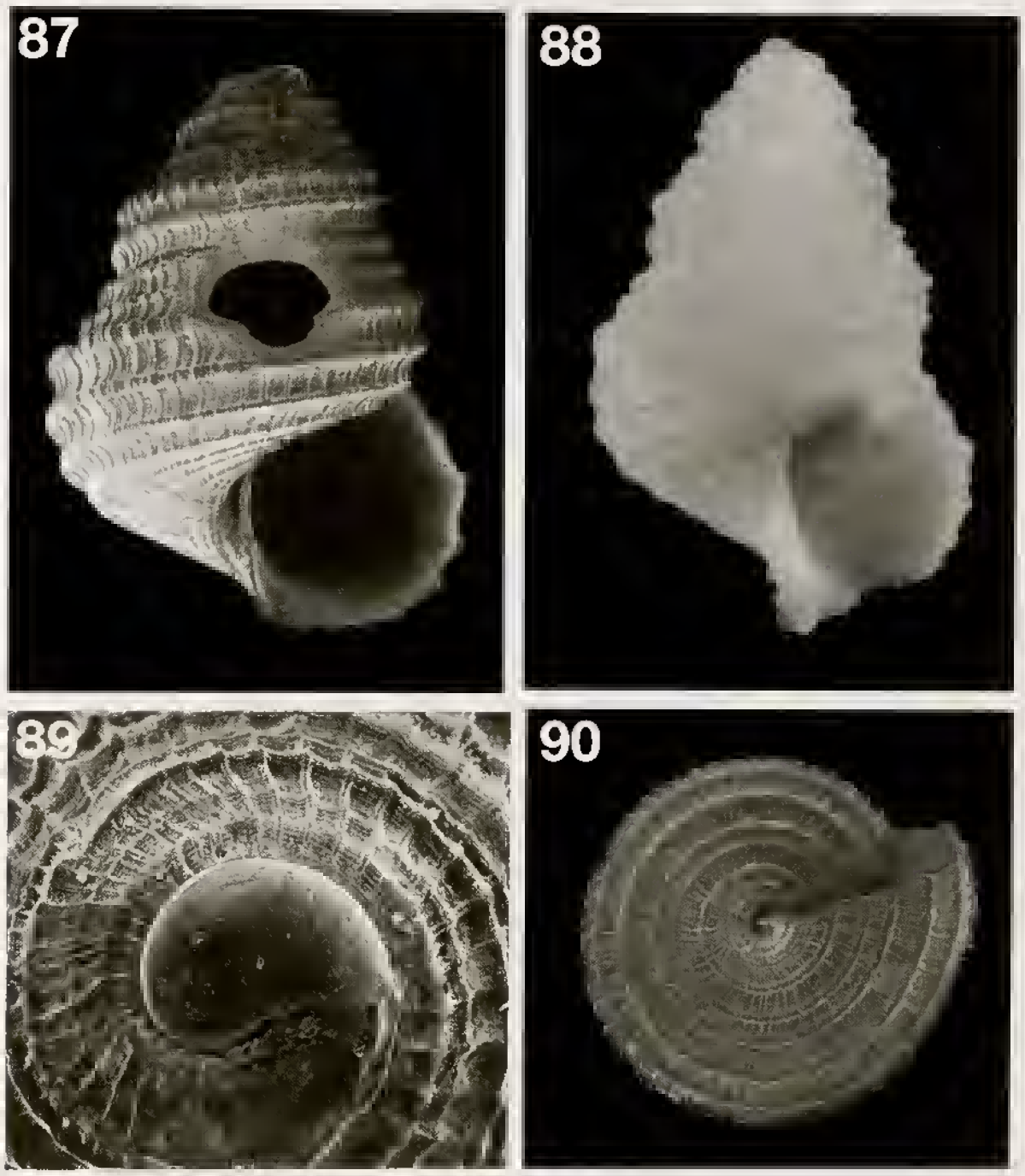
MATERIAL EXAMINED. — Holotype.
New Caledonia. BIOCAL: stn DW 77, 22°15′ S, 167°15′ E, 440 m, 1 dd (paratype).

DISTRIBUTION. — Apparently widely distributed, with known specimens from South Africa and New Caledonia.

DESCRIPTION. — *Protoconch* [only outer base available for non-destructive study]: smooth; globular, strongly hyperstrophic, almost completely upside-down (over 145° to first teleoconch whorl); 580 µm in maximum exposed diameter; with weak, hardly elevated peritreme. Weak, slightly curved anal keel (ca. 80 µm) bordering deep protoconch umbilicus; umbilicus partly covered by thin, brittle, reddish-brown callus extending between first TW and anal keel. Glassy white, with outermost anal keel region brown.

Teleoconch: thin, shiny, especially in cancellate "windows"

Source : MNHN, Paris



FIGS 87-90. — *Tuba fuscocincta* sp. nov. — **87**, paratype, New Caledonia, lateral aspect, 4.1 mm. — **88**, holotype NMP C8591/T1185, Transkei, South Africa, 7.2 mm (light photograph, showing color pattern on spiral ribs). — **89**, aspect of protoconch and first teleoconch whorl, paratype, protoconch diameter 580 µm. — **90**, shell base, paratype, diameter 3.1 mm.

Source : MNHN, Paris

translucent; 4.1 to 7.2 mm at 3 1/4 to 4 3/8 whorls. Spire angle initially about 50°, later decreasing to approximately 47° on body whorl. Distinct arrested growth mark at about 1/6 of first whorl. Upper part of each teleoconch whorl with "2+2" pattern of exposed primary spiral ribs. The less prominent upper pair is closely spaced, with the upper (first) rib stronger; the following pair, together with a fifth spiral rib (the latter on early whorls partly covered by the attaching following whorl) forming angular peripheral region. On body whorl, these 3 peripheral ribs equally spaced, with slight decrease in rib strength from top to bottom. Umbilicus narrow, open. Base with 6-8 well-defined more-or-less equally spaced spiral ribs, the outermost of which strongest. Larger specimen with additional threads between primary ribs (Fig. 91). Spiral ribs and interspaces crossed, mostly at right angles, by axial riblets, always finer than the weakest spiral rib. Spacing of the axials on the upper side regular (32-34 on second TW, 41-46 on third), but crowded on base due to converging axial riblets, especially close to umbilicus. Surface, notably the uppermost (first) spiral rib, with microscopic spiral striae. Coloration: white; beginning on first TW, the fourth primary spiral rib becoming gradually darker, reaching a solid orange-brown after 2 TW; the rib below it (= upper point of attachment of subsequent whorl) also brownish (on smaller specimen only), but much lighter; a third brown rib surrounding the 2 tightly-spaced ribs at the umbilicus; remainder of shell off-white.

Animal: unknown.

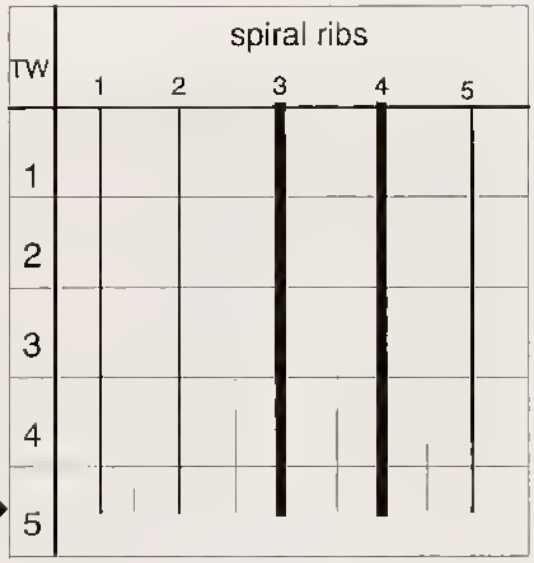


FIG. 91. — *Tuba fuscocincta* sp. nov. Diagram of spiral sculpture, as in Fig. 8.

Measurements:

	H	D	PD	TW	Locality	Collection
Holotype	7.2	4.7	580	4 3/8 [was 4 1/2]	[type loc.]	NMP C8591/T1185
Paratype	4.1	3.1	580	3 1/4 [was 3 1/2]	New Caledonia	MNHN

REMARKS. — Although known from only two specimens, the distinctive coloration in conjunction with a strongly hyperstrophic protoconch and well-defined teleoconch sculpture separate this form from other known mathildids and justify description as a new species. The paratype is a fresher specimen, with the shell coloration better preserved. The species is placed in *Tuba* rather than *Mathilda* (*sensu lato*), mainly because of its broadly rounded shell and strongly hyperstrophic protoconch.

ETYMOLOGY. — *Fuscocinctus, -a, -um*, compound adjective from Latin *fuscus, -a, -um* (brown) and *cinctus, -a, -um* (having a girdle); referring to its distinctive brown spiral bands.

Nominal mathildid species removed from the family

Mathildona cookiana Dell, 1956 (: 39, fig. 30); "40°52.6′ S, 174°49.5′ E, Cook Strait, in 75 fathoms" [137 m; New Zealand]. DELL noted in the original description that the apex was damaged in all available specimens and that the "generic position cannot be certain" (1956: 39). POWELL (1979: 250) retained the species tentatively in nominal genus *Mathildona*, while MAXWELL (1966: 447) noted that DELL's species "is almost certainly not congeneric with the genotype *M. euglypta* Iredale, differing in having strong axial folds, an arcuate columella, and a continuous peristome". The holotype (NMNZ M8842, H= 9.8, D= 3.7; Fig. 92) lacks mathildid-typical

Source : MNHN, Paris

sculptural elements. Additional specimens studied (NMNZ) have complete protoconchs and identify this species as a member of the Epitoniidae.

Mathilda elegantula Angas, 1871 (: 15, pl. 1, fig. 8); "Lane Cove Creek, Port Jackson", New South Wales, Australia. *M. elegantula* was made the type species, by OD, of *Eucharilda* Iredale, 1929 (: 187, no family placement indicated). The holotype (BMNH 1871.7.5.9, H= 11.3, D= 2.9; Fig. 93) appears to be a member of the Pyramidellidae. THIELE (1931: 269) suggested synonymy with the pyramidellid genus *Cingulina*.

Mathilda eurytima Melvill & Standen, 1896 (: 310-311, pl. 11 [1897], fig. 73), from the Loyalty Islands. This species was based on two specimens. The originally illustrated syntype (MUM EE 3730; H= 6.4, D= 2.6) is here shown in Fig. 94. The second specimen (NMW 1955.158.203; H= 6.4, D= 2.6; *vidi*) is mentioned in the original description as having been called "*Mathilda sinensis*" in an earlier work (MELVILL & STANDEN, 1895: 117; there with reference to non-existing illustration). *Mathilda eurytima* is now known to be based on immature specimens of *Cerithium nodulosum* Bruguière, 1792 (see HOUBRICK, 1992: 126 ff.; TOMLIN, 1936: 150). HOUBRICK gave an illustration of the second specimen (1992: fig. 89E; as *Matilda* [*sic*], erroneously citing the collection number as "NMW 1955158207"). HOUBRICK's (1992: 127) reference to the two type specimens as "syntype" and "paralectotype" does not fulfill ICZN Article 74(b) for a lectotype designation 'by inference of holotype'. The originally illustrated syntype (MUM) is here selected as lectotype.

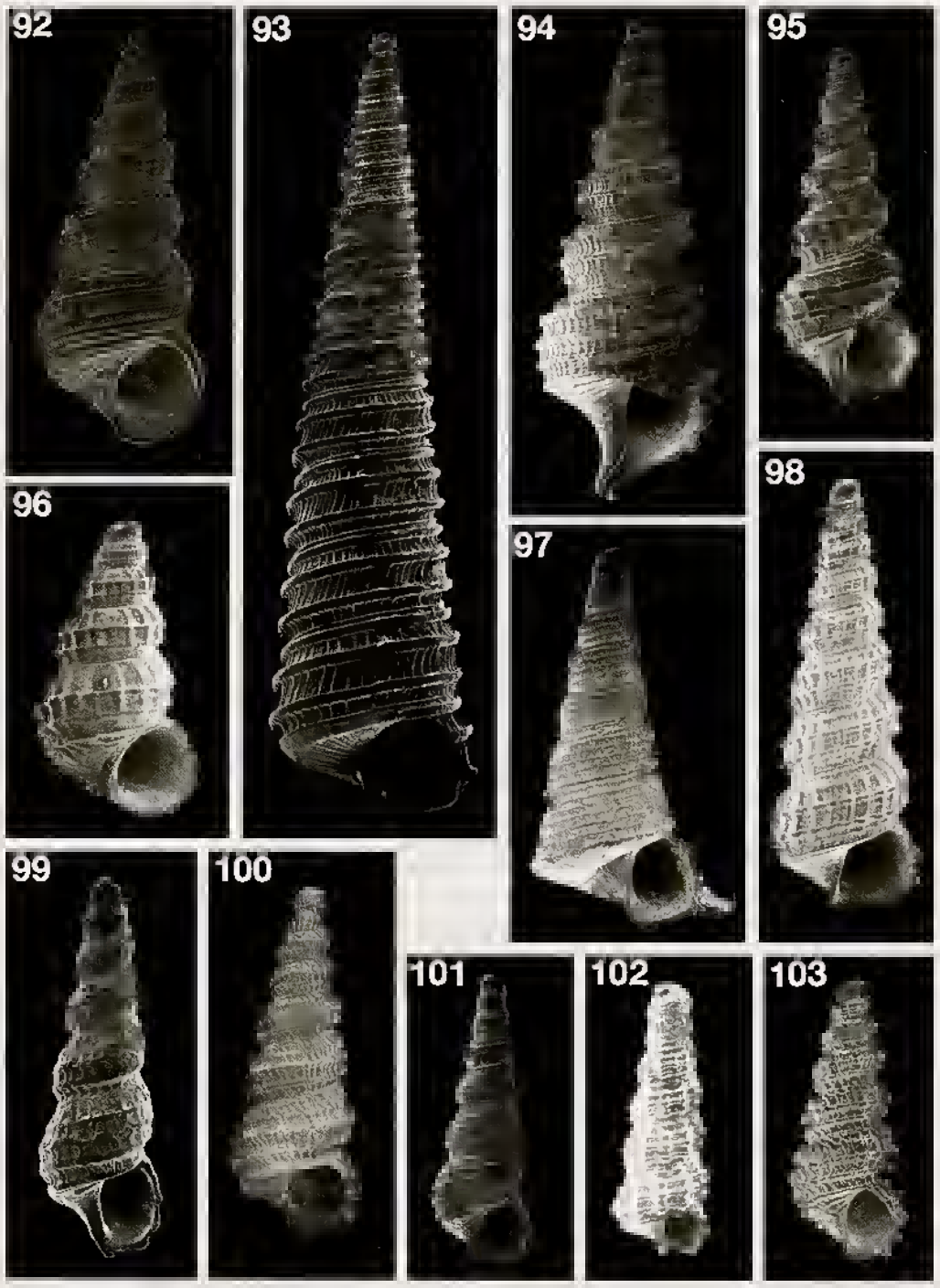
Mathilda gracillima Melvill & Standen, 1901 (: 378-379, pl. 22, fig. 18); "Gulf of Oman: lat. 24° 55' N, long. 57° 59' E, 37 fathoms [68 m], sand and mud bottom." The original authors did not indicate a single type specimen; TREW's (1987: 43) reference to "Holotype: BM(NH) 1901.12.9.145" qualifies as lectotype designation in accordance with ICZN Article 74(b). This specimen (H= 11.0, D= 4.1; Fig. 95), which agrees with the original illustration and given dimensions ("Long. 11, lat. 4 mm"; MELVILL & STANDEN, 1901: 379), has a homeostrophic protoconch and lacks *Mathilda*-typical outer basal sculpture. It is considered a member of Capulidae (Trichotropidae) by WARÉN (*in litt.*, Dec. 1993).

Mathilda oppia Hedley, 1907 (1907b: 500, pl. 16, fig. 9); Masthead Reef, Capricorn Group, Queensland, Australia, 23°32' S, 151°45' E, 31-37 m. This nominal species was originally described from a "few specimens", without indication of a holotype. The originally figured syntype (AMS C21782; H= 3.35, D= 1.8; Fig. 96) is here selected as lectotype. In contrast to the original description, the specimen does not have a heterostrophic protoconch. It appears to be a member of the Rissoidae, probably belonging to the genus *Alvania* Risso, 1826 (B. MARSHALL *in litt.*, March 1994).

Turritella opulenta Hedley, 1907 (1907a: 292, pl. 54, fig. 9); 5-6 miles off Cape Three Points, NE of Broken Bay, New South Wales, Australia, 74-91 m. *T. opulenta* became type species (OD) of *Glyptozaria* Iredale, 1924 (: 248), a genus that LASERON (1951) erroneously synonymized with *Mathildona* Iredale, 1929 (see discussion under *Mathilda decorata*, above). *Glyptozaria opulenta* was recognized as a member of family Cerithiidae (see HOUBRICK, 1981: 838 ff.). The specimen here illustrated (AMS C16764; Fig. 98) was received as the holotype lot. However, the specimen is smaller (H= 4.2, D= 1.7) and has fewer whorls (TW= 6 1/4) than the specimen of the original description.

Eucharilda pleurorbis Laseron, 1951 (: 331, fig. 84); Manly Beach, Sydney, New South Wales. The smaller of two specimens in the type lot (AMS C103226) has a complete homeostrophic apex and is closest to the original description. It is here selected as lectotype (H= 3.2, D= 1.1; Fig. 101). This nominal species is a synonym of the triphorid *Seilarex turritelliformis* (Angas) (*teste* MARSHALL *in litt.*, March 1994).

Source : MNHN, Paris



FIGS 92-103. — Nominal "mathildids" removed from the family (SEM, uncoated). — **92**, holotype of *Mathildona cookiana*, NMNZ M8842, New Zealand, 9.8 mm. — **93**, holotype of *Mathilda elegantula*, BMNH 1871.7.5.9, New South Wales, 11.3 mm. — **94**, lectotype of *Mathilda eurytima*, MUM EE 3730, Loyalty Islands, 6.4 mm. — **95**, lectotype of *Mathilda gracillima*, BMNH 1901.12.9.145, Gulf of Oman, 11.0 mm. — **96**, lectotype of *Mathilda oppia*, AMS C21782, Queensland, 3.35 mm. — **97**, lectotype of *Mathilda rosae*, AMS C8976, New South Wales, 5.0 mm. — **98**, specimen (type material?) of *Turritella opulenta*, AMS C16764, New South Wales, 4.2 mm. — **99**, lectotype of *Opimilda porrigata*, AMS C103222, New South Wales, 4.1 mm. — **100**, syntype of *Dunkeria pulchella*, 1860, BMNH 1878.1.28.329, Japan, 3.3 mm. — **101**, lectotype of *Eucharilda pleurorbis*, AMS C103226, New South Wales, 3.2 mm. — **102**, holotype of *Opimilda protolineata*, AMS C03225, New South Wales, 2.0 mm. — **103**, syntype of *Dunkeria scabra*, BMNH 1878.1.28.334, Japan, 2.9 mm.

Source : MNHN, Paris

Opimilda porrigata Laseron, 1951 (: 332, fig. 82); Point Halliday, near Taree, New South Wales, Australia. The larger of two syntypes (AMS C103222) is in slightly better condition and is here selected as lectotype (H= 4.1, D= 1.4; Fig. 99). MARSHALL (*in litt.*, March 1993) suggested possible placement in the Cerithiopsidae.

Opimilda protolineata Laseron, 1951 (: 331, fig. 81); Manly Beach, Sydney, New South Wales, Australia (holotype AMS C103225, H= 2.0, D= 0.8; Fig. 102). The species was placed in the Triphoridae, genus *Metaxia* Monterosato, 1884, by MARSHALL (1983: 16).

Dunkeria pulchella A. Adams, 1860 (1860a: 120); from "off Mino-Sima [Mino-Shima]; 63 fathoms", Japan. This species was subsequently referred to as *Mathilda pulchella* (A. Adams) by HABE (1977: 158, fig. 6), and by HIGO & GOTO (1993: 351). Based on sketches taken by MAKIYAMA during his stay in London in 1929, HABE (1977: 158) placed this nominal species in the Mathildidae, arguing that the "figured specimen has the large and globular protoconch and the latticed sculpture on the surface of the shell". The originally figured syntype (BMNH 1878.1.28.329; H= 3.3, D= 1.2; Fig. 100), has a homeostrophic protoconch. It is considered a member of Epitoniidae (WARÉN *in litt.*, Dec. 1993).

Mathilda rosae Hedley, 1901 (: 721, pl. 48, figs 13-14); "Balmoral Beach, Middle Harbor, near Sydney", New South Wales, Australia. The figured syntype (AMS C8976) is here selected as lectotype (H= 5.0, D= 2.8; Fig. 97). This is the type species, (OD), of genus *Charilda* Iredale, 1929 (: 187, no family placement indicated). WARÉN (*in litt.*, March 1994) recognized it as a member of family Eulimidae.

Dunkeria scabra A. Adams, 1860 (1860b: 421); "Tsu-Sima [Tsu-Shima]; 16 fathoms [29 m]", Japan. Based on sketches taken by MAKIYAMA during his stay in London in 1929, HABE (1977: 158-159, fig. 5) placed this nominal species in the Mathildidae, stating that this "is also a member of the genus *Eucharilda* in the family Mathildidae, resembling the young *Eucharilda sinensis* (Fischer)". More recently, HIGO & GOTO (1993: 351) placed the species in *Mathilda sensu stricto*. The syntype in London (BMNH 1878.1.28.334; H= 2.9, D= 1.2; Fig. 103) has a homeostrophic protoconch and a sculpture much unlike *Mathilda sinensis*. WARÉN (*in litt.*, Dec. 1993) recognized it as a member of family Epitoniidae.

Nominal species removed from the *Mathilda* (*sensu lato*) group

Opimilda fastigia Laseron, 1951 (: 332, fig. 83); "Port Stephens", New South Wales, Australia (holotype AMS C103223, *vidi*). The protoconch of the type specimen is not heterostrophic, the species may be related to the following.

Mathilda neozelanica Suter, 1908 (: 40, pl. 3, fig. 53); "Hauraki Gulf", New Zealand. This taxon was made type species of *Brookesena* Finlay, 1926; a group with homeostrophic protoconchs.

Nomina nuda for Indo-Pacific Mathildidae appearing in the literature

DE BOURY (1911) discussed "*Mathildia*" [*sic*] specimens in the DE FOLIN collection (MNHN). By quoting apparently unpublished label information by DE FOLIN, DE BOURY (1911: 68-69) introduced the following *nomina nuda* for Indo-Pacific forms:
"*Mathildia complexa*" from "Maurice (?)".
"*M. crenata*" from "îles Andaman (?)".
"*M. effusa*" from "Panama"; recognized by DE BOURY (1911) as the apex of a *Rissoina*.

Source : MNHN, Paris

"*M. incisa*" from "îles aux Perles, Panama (?)".
"*M. ovula*" from "îles aux Perles (?)".
"*M. procera*" from "îles Andaman (?)".

These names, as well as DALL's (1927: 88) *nomen nudum* "*Mathilda dionedae*", have no nomenclatural standing.

DISCUSSION

Species diversity. The discovery of 15 mathildid species and several additional "forms" in the New Caledonian region further demonstrates the high biotic diversity in this region. Previous reports usually described only a few mathildid species in any given area (*e.g.*, SPRINGSTEEN & LEOBRERA [1986: 57] mention only "1 or 2" species presently reported from the Philippines). A similarly large number of mathildids in the Recent fauna was reported by LASERON (1951) for New South Wales. His *Mathilda*-group comprised nine species. However, as was shown above, six of these belong to other families, two are synonymous and one appears to belong to *Brookesena* (a possible mathildid group without heterostrophy), leaving only one species here considered a member of the *Mathilda*-group.

Morphological diversity. *Rib pattern*: in the past, *Mathilda* (*sensu lato*) has been defined as displaying a pattern of two pairs of primary spiral ribs, with the lower pair usually stronger (GRÜNDEL, 1973: 949; 1976: 342). Several of the New Caledonian taxa show this "2+**2**" pattern at least on their early teleoconch whorls (*Mathilda* cf. *amauda*, *M. decorata*, *M. houbricki*, *M.* sp. A). Others (*M. maoria*, *M. hendersoni*, *M. richeri*, *M. salve*, *M.* sp. aff. *sansibarica*) differ slightly by having the third rib more strongly developed, thus displaying a pattern of "2+**1**+1". There is only a gradual difference between these variant patterns, as exemplified by *M. salve* whose larger shells show an ontogenetic change from "2+**1**+1" to "2+**2**". However, other species differ in more profound ways. *M. boucheti* and *M. brevicula* only show 3 ribs, with the central one weakest ("**1**+1+**1**"). *Mathilda maculosa* starts the first teleoconch whorl with only three ribs in a "1+**2**" pattern and then changes ontogenetically to "2+**2**". *Mathilda fusca* displays a unique "**1**+2+**1**" pattern with the outer ribs strongest. *Tuba* species usually show more than four exposed primary ribs. Whether these patterns indeed qualify to describe monophyletic groupings is unclear at this point and will depend on future corroboration by other characters.

Umbilicus: the presense or absense of an umbilicus has been a traditional character to distinguish between mathildid (sub)genera. However, the New Caledonian taxa show a wide range of umbilical features: *Mathilda brevicula* (in contrast to otherwise similar *M. boucheti*) and *Mathilda* sp. A (in contrast to otherwise similar *M. decorata*) have open, funnel-shaped umbilici. Other New Caledonian *Mathilda* species have either solid columellae or narrow umbilical chinks that are more-or-less covered by columellar lip attachments. In *Tuba*, the umbilicus is either open and narrow, or closed by the reflected columellar lip.

Generic subdivision. *Tuba* (or *Gegania*) differs from other investigated mathildids in several characters of the internal anatomy, especially the buccal apparatus (HASZPRUNAR, 1985). However, the wide range of shell features encountered in this study blurs the traditional line of distinction between *Mathilda* and *Tuba* based on *shell characters* alone. *Mathilda* (*sensu lato*) was usually considered to comprise high-spired shells with few dominant spiral ribs and a protoconch that was distinctly hyperstrophic, but not "upside-down". In contrast, *Tuba* shells were seen as less tall, rounded, with numerous, finer spiral ribs and a strongly hyperstrophic protoconch that was placed almost "upside-down" on the first teleoconch whorl. The specimen recognized as *Mathilda* cf. *hendersoni* has a very slender shell combined with a very strongly hyperstrophic protoconch, while the specimens of *Tuba fuscocincta* start out with a *Mathilda*-like "2+**2**" teleoconch rib pattern.

Source : MNHN, Paris

Long distance dispersal. Like the species in its supposed sister taxon, Architectonicidae, many mathildid taxa are here found to have wide geographic distribution. Long-range (teleplanic) larval dispersal has been demonstrated for architectonicids (ROBERTSON, 1964; SCHELTEMA, 1968), and the larval shells are very similar in the two families (living mathildid larvae have not yet been described). Further range extensions are likely to be found with increasing knowledge of the group. Again parallel to the situation found in the Architectonicidae (BIELER, 1993), most of the widely distributed Indo-Pacific mathildid species do not appear to extend into the Atlantic Ocean. One possible exception is *Mathilda* cf. *hendersoni*.

Future work. This work is the first step of a revision of worldwide Mathildidae. Further taxonomic changes in this group must be expected. Generic allocations will stabilize as anatomical material becomes available. New synonymies will result from comparisons with Neogene fossils and, possibly, with nominal species not originally described from the Indo-Pacific. Future taxonomic descriptions should not be based solely on juvenile specimens or on shells lacking the protoconch. Descriptions of mathildids must include detailed data on the protoconch (statements such as "bulbous," "globose," or "rather heterostrophic" are insufficient), and they must include illustrations of the teleoconch (*i.e.*, by careful drawings or SEM photomicrographs, with sculptural details enlarged). "New" species should be discussed within the context of previously named forms in at least the same ocean system, and should be based on type material that is available to the scientific community (*i.e.*, deposited in accessible, professionally maintained facilities).

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Source : MNHN, Paris

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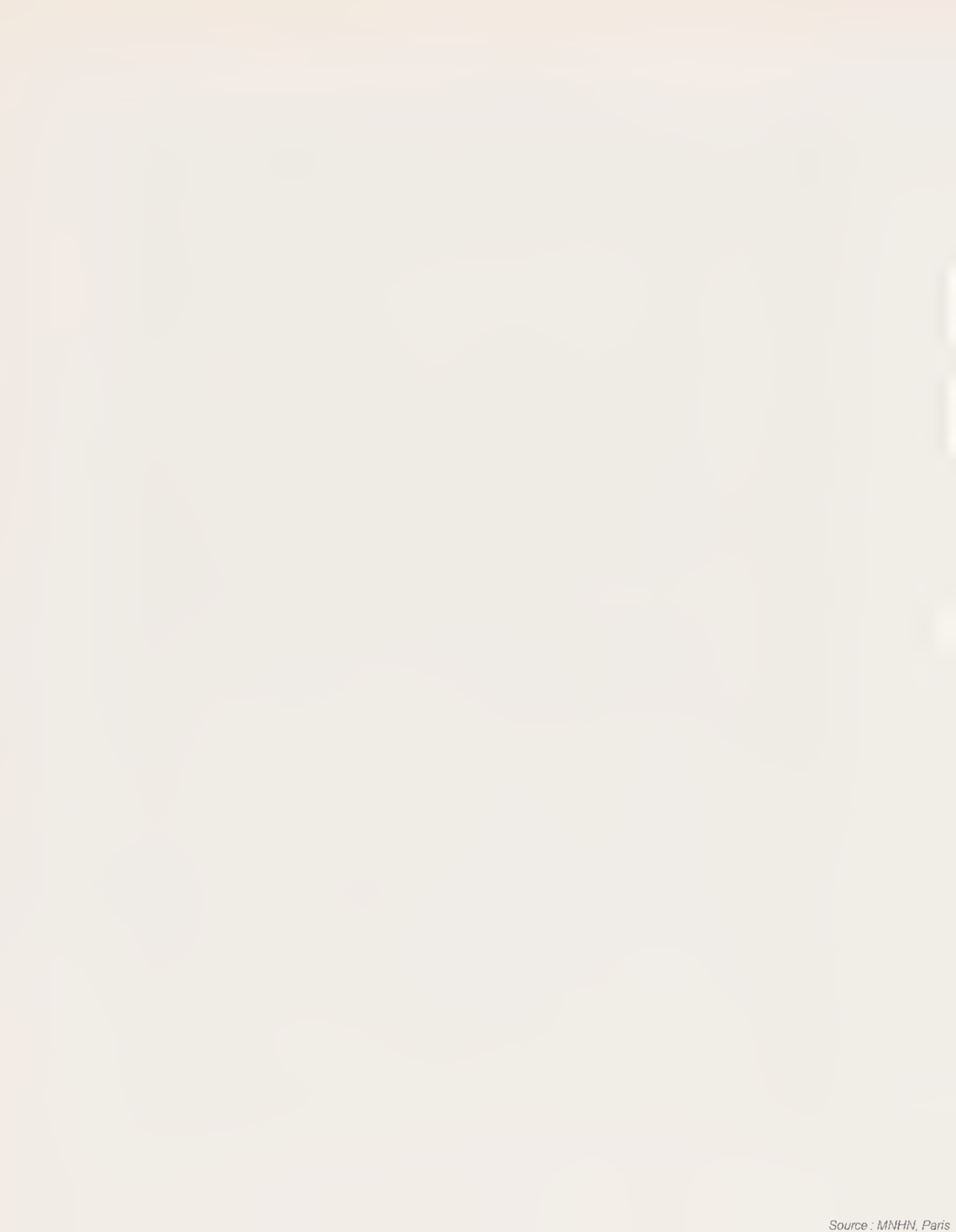

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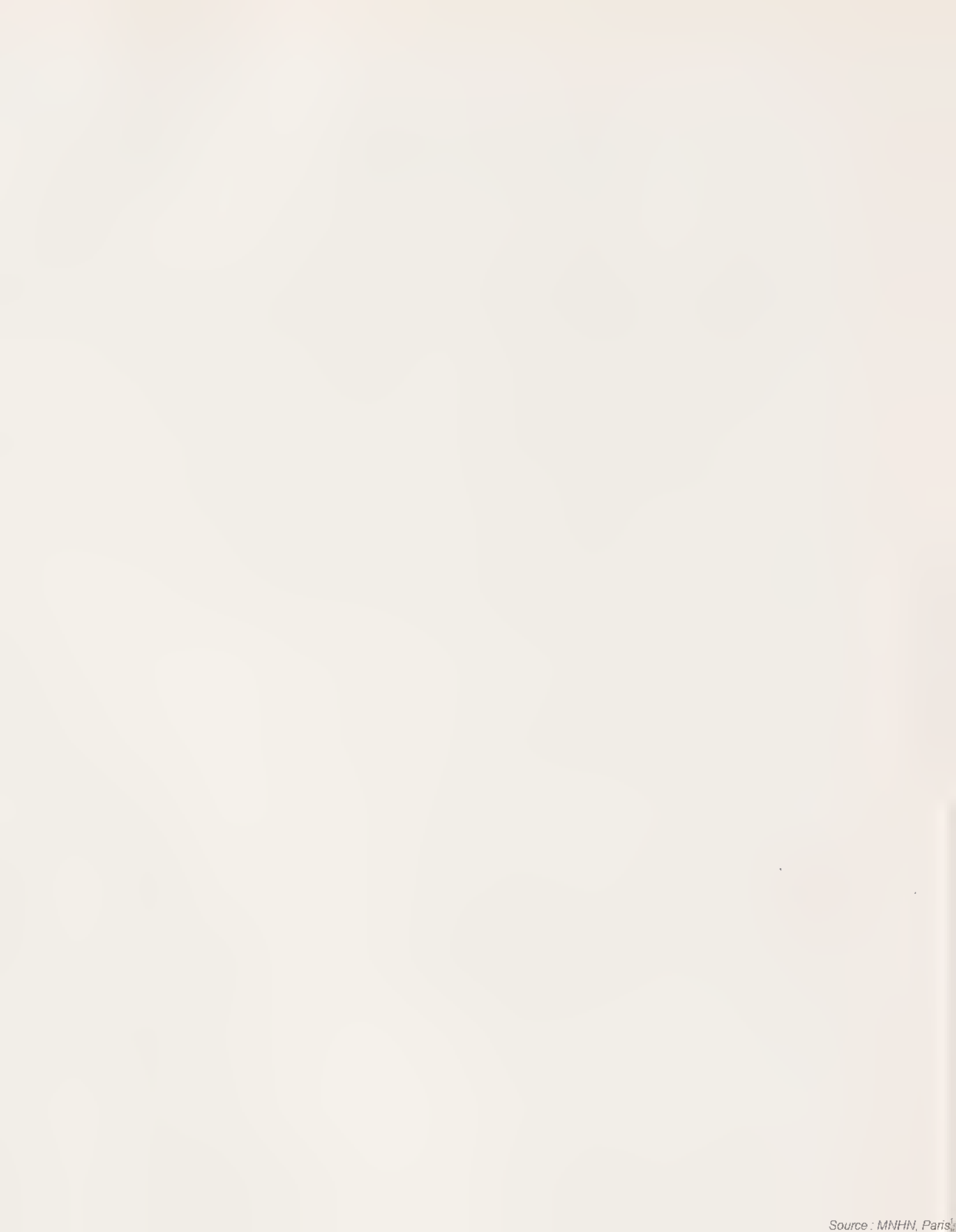

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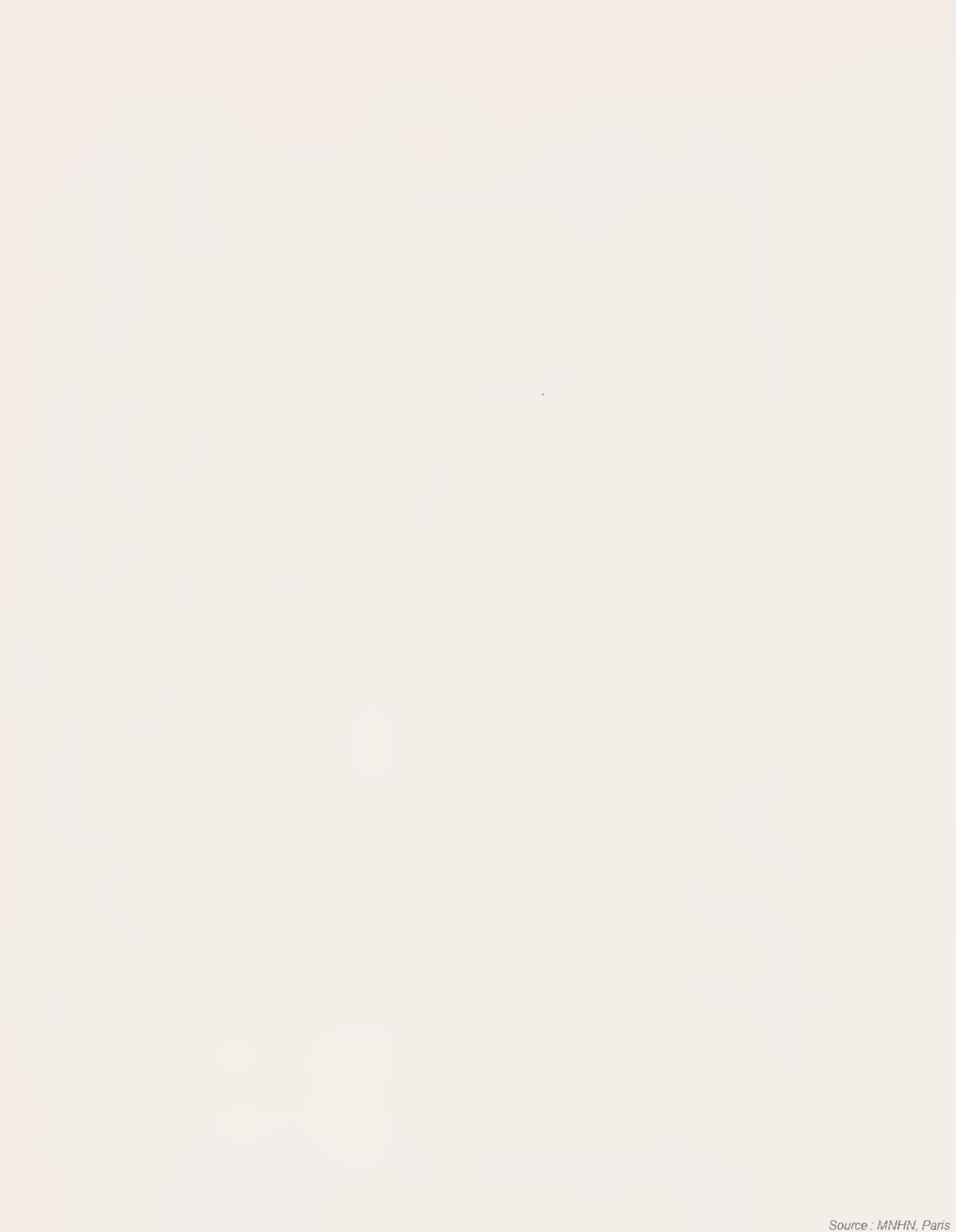

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